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ENLARGEMENT OF THE PROSTATE

ITS TREATMENT AND RADICAL CURE

BY

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PREFACE.

Two years ago, in the Hunterian Lectures delivered at the Royal College of Surgeons, I pointed out that, in striking contrast to the great advance made by surgery in other directions, there had been but little progress of late in the treatment of Enlargement of the Prostate. Operation with a view to permanent cure was still regarded as upon its trial, and the catheter was looked upon as almost the sole means for obtaining relief.

Since then much has been accomplished. New methods have been devised. Wider experience has confirmed the opinion I expressed as to the merits of more active measures than those usually adopted. The old view as to the purely sexual character of the prostate, which had been almost forgotten and which I supported strongly, has gained ground again, and, in its turn, has led to the discovery of other methods; and now it is not too much to say that perfect relief can be assured even in the most advanced stages of the disorder. Further improvements no doubt will follow; but it has seemed to me that the time has come when that which has been done already might profitably be gathered together and recorded.

I am aware that in many respects the conclusions I have ventured to express differ materially from those still current. It will be thought, for example, that I have laid undue stress upon the evils that attend the habitual employment of catheters. But the very considerable opportunities I have enjoyed of studying the course of prostatic disease under the most varied conditions have left in my mind no doubt as to the comparative merits of the different methods that I have tried to describe impartially.

C. W. MANSELL MOULLIN.

69, Wimpole Street.

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ENLARGEMENT OF THE PROSTATE

ITS TREATMENT AND RADICAL CURE.

CHAPTER I.

THE NORMAL STRUCTURE AND FUNCTION OF THE PROSTATE.

SIZE AND WEIGHT—RELATIONS—GENERAL STRUCTURE—THE MEDIAN LOBE—BLOOD SUPPLY—MINUTE ANATOMY—THE PROSTATIC URETHRA—THE VERU MONTANUM—THE PROSTATIC UTRICLE—HENLE'S MUSCLE—THE DEVELOPMENT OF THE PROSTATE—ITS FUNCTION—THE CAPUT GALLINAGINIS, AND THE RELATION OF THE PROSTATE TO THE SPHINCTER OF THE BLADDER.

THE prostate is a glandular organ, containing a large amount of fibrous and unstriped muscular tissue. It is placed around the first portion of the urethra and the orifices of the ejaculatory ducts. In function it is entirely sexual.

Its structure and relations are best studied in the young adult. At that time of life it has attained its full development, and has not yet undergone any pathological change.

The prostate is formed of two lobes, separate from each other in the fœtus, but joined together across the middle line in the adult. The shape is that of a truncated cone, placed with its apex downwards. The base is reniform in outline, convex in front, with, in the middle line behind, a depression as evidence of its mode of growth. Below the base the outline is more nearly circular, but the extent to which the separation of the lobes can be traced on the exterior varies greatly in different subjects and at different ages.

Size and weight.—The greatest length is 4 centimetres; breadth from 4 to 4·5; depth from 2 to 2·5. The average weight is from 4·5 to 4·75 drachms (Thompson, "Diseases of the Prostate," 6th edit.).

Relations.—Above it, in the erect position, and resting upon the base, is the bladder, distinctly separate in the young subject. Below it is the deep layer of the triangular ligament of the urethra, with

which its sheath is continuous. In front, at a distance of about half-an-inch, is the posterior margin of the symphysis pubis. On either side are the levatores prostatæ muscles, descending from the pubes, and, as it were, suspending the gland between them. Behind, entering the depression in the middle of the upper border, are the two ejaculatory ducts. These, with the vesiculæ seminales and the vasa deferentia, are held against the under surface of the bladder by a thin sheet of fascia, which, lower down, becomes continuous with the capsule of the gland. This sheet of fascia is all that separates the upper part of the prostate from the middle third of the rectum. Towards the apex of the gland the interval grows wider, the urethra inclining forwards, the rectum backwards.

The sheath that encloses the prostate is derived from the recto-vesical portion of the pelvic fascia. It is attached above to the posterior surface of the pubes and the sides of the pelvis. From this it descends to the groove that marks the junction of the bladder and prostate, except behind, where it does not reach lower than the posterior extremities of the vesiculæ seminales. At this level it divides into two. One layer passes upwards, and is lost in the wall of the bladder. This forms the floor of the pelvis, and shuts out from the proper pelvic cavity the prostate, the under surface of the base of the bladder, and the vesiculæ seminales. The other passes downwards, forms the sheath of the prostate, binds the vesiculæ seminales to the bladder, and is lost in the deep layer of the triangular ligament of the urethra. The prostatic plexus lies in the groove where the two layers diverge, and separates the descending one from the capsule of the gland.

Two parts of this fascia are distinguished from the rest as the anterior and lateral true ligaments of the bladder. They pass downwards and inwards from the posterior surface of the pubes and the sides of the pelvis respectively, and are somewhat stronger than the rest. Between the two anterior ones in the middle line is a narrow depression, formed by the fascia sinking down, to be attached to the capsule of the gland near its apex, at its junction with the triangular ligament.

The urethra passes from above downwards, between the anterior margins of the lateral lobes. As it descends it curves forwards, so that the posterior surface of the gland is slightly longer than the anterior. The relative thickness of the tissues in front and behind the canal varies a good deal in different subjects. "It appears to

me, judging from the conformation of the specimens, and not from the cut surfaces merely, that there is a rather larger mass of prostatic substance below (behind) than above (in front of) the urethra in all these specimens, except two or three" (Thompson). The bulk of the gland lies on either side, projecting outwards and backwards to form the lateral lobes.

The ejaculatory ducts enter side by side in the notch between the lateral lobes. They run forwards and slightly downwards, to enter the prostatic portion of the urethra a little below the middle. The lateral lobes, so far as their upper extremities are concerned, lie along the outer borders of these ducts. Below, they converge and meet upon the wall of the urethra. As they descend they fill up the open angle formed at the point of junction.

The relation of the prostate to the bladder.—As the circumference of the bladder diminishes towards the neck the longitudinal muscular bands collect into two main groups, one in front and one behind. These interlace to some extent with each other. Then changing their direction they sweep obliquely round, and are lost upon the prostate. The circular coat, if examined by making a vertical median section after the parts have been hardened in spirit, increases slightly in thickness at the neck. There is not, however, here anything that could be called a sphincter. Then it suddenly diminishes and is continued into the circular muscular coat of the urethra. In this the bundles, according to Griffiths, are more closely packed, and form a denser layer than in the bladder. The muscles of the ureters, which meet near the vesical orifice, are prolonged down the urethra, chiefly along its posterior wall. Here they form an innermost longitudinal layer, interlacing behind and in the substance of the veru montanum, and lying almost immediately under the epithelium. The contraction of these fibres tends to shorten and dilate the urethra, and by bringing the surface of the trigone closer to the caput gallinaginis to level the angle between it and the bladder.

The two lobes of the prostate belong not so much to the urethra as to the ejaculatory ducts. In many mammals they are attached to them on their outer sides at some little distance from the bladder. In man there is no interval, and hence they appear to be interposed for a very short distance between the two chief muscular layers of the bladder. The longitudinal coat, which has to a certain extent an independent origin from the puboprostatic

and other ligaments, is lost upon their outer surface. The circular one is continued down between them in the wall of the urethra.

STRUCTURE.

The capsule.—The prostate, except at its base and apex, is invested by a capsule of strong fibrous tissue. From this trabeculæ pass into the interior, dividing and supporting the gland tubules. The prostatic plexus of veins surrounds the base in front and along the sides. Here it separates the capsule from the sheath of recto-vesical fascia. Over the lower part of the gland the two are continuous. Both are lost upon the deep layer of the triangular ligament.

The secreting tissue of the prostate is collected chiefly into two masses. These are placed one on each side of the urethra and the ejaculatory ducts, and form the lateral lobes. Usually there are a few isolated glands in the median line behind, with ducts that open into the urethra between the posterior end of the veru montanum and the vesical outlet. "The secretion may be seen oozing from these orifices when the median part of the prostate behind the veru montanum is compressed" (Griffiths, "Jour. of Anat. and Phys.," 1888-9). More rarely a few are to be found in front as well.

The stroma, which consists of fibrous and muscular tissue, is distributed with greater uniformity. In front of the urethra it forms the whole of the prostate, and is known as the anterior commissure. Glandular tissue here is the exception. The closely-packed bundles of fibres extend transversely from side to side, and radiate outwards among the gland tubules of the lateral lobes. Under the capsule and immediately around the urethra there is usually a thin uninterrupted layer, except that in the latter situation it is perforated here and there by the ducts.

Behind the urethra the arrangement varies at different levels. Near the apex the gland tissue of the opposite lobes may come into contact across the middle line. Higher up, just below the ejaculatory ducts, there is an interval, bridged across by stroma as in front—the posterior commissure. Higher still, between and above the ducts, there is in some instances a distinct little glandular mass, separate from the lobes on either side, but rarely large enough to form a projection between them.

The median lobe.—The existence of a median lobe as a normal structure is not admitted by Sir Henry Thompson. "I cannot find

in healthy bodies below fifty years of age any formation in the situation described capable of being recognized as a distinct 'third' or 'middle lobe,' and am compelled to conclude that any marked prominence there which appears to possess independent characters (as regards size or form) must be considered abnormal or morbid." Sir H. Thompson, however, goes on to say that he considers it desirable to adopt for the upper segment of this posterior commissural part a term which the French anatomists have employed, viz., "the median portion," on the ground that it has a specific character which distinguishes it from other parts. "This character seems to be connected with that tendency to enlarge which this portion of the organ undoubtedly possesses. It is this, that the portion in question certainly contains a larger proportion of glandular structure than most other parts of the entire organ. Thin slices from this portion placed under the microscope and compared with slices from other parts demonstrate this very clearly" ("Diseases of the Prostate," 6th edit.).

I have repeatedly found tubules in this situation myself, both in the infant and in the adult.

Whether this part of the prostate lying between and above the ejaculatory ducts should be called the "median portion" or the "median lobe" seems to me to be immaterial. In many it is absent; in a fair proportion the tubules are easily found; in a few they are so numerous and so large as to form a definite little mass, thicker in the middle than at its borders, where it joins the lateral lobes. It depends upon the extent to which the prostatic tubules have been displaced from their original site in the course of racial development. In some they all retain their primitive bilateral position; in others a greater or smaller number have been shifted towards the middle line as well as downwards. The pathological median lobe, the structure that projects so frequently into the vesical orifice, and is such a serious impediment to micturition, has nothing to do with the anatomical median portion. As I have shown in my "Hunterian Lectures on the Operative Treatment of Enlargement of the Prostate," in many instances, if not in all, it originates entirely independently of it.

Blood vessels.—The arterial supply of the prostate is not very large. One important branch comes off from the inferior vesical artery, and others, smaller ones, from the internal pudic directly and from its middle hæmorrhoidal branches. Occasionally there is an

accessory pudic. Branches from these vessels pierce the capsule near the base and form a network around the secreting tubules.

The veins, on the other hand, are naturally capacious, and in old people frequently attain an enormous size. In the submucous layer of the urethra, chiefly along its posterior wall, there are large venous sinuses which communicate freely with the submucous plexus around the neck of the bladder. Sometimes these form great varicose masses projecting under the mucous membrane. In the prostate itself there is an immense number of small thin-walled veins around and between the gland lobules. From these short wide channels pass upwards and outwards through the capsule, to open directly into the plexus that surrounds it.

This plexus is contained between the capsule and the sheath of the gland. It is formed in front by the dorsal vein of the penis and some small vessels that come from the lowest part of the anterior surface of the bladder. As it passes back it divides, surrounding the base of the prostate at its junction with the neck of the bladder. Farther back the two halves unite again, between the under surface of the trigone and the vesiculæ seminales. Here they communicate with the veins from the anus and the peri-rectal tissues, and receive nearly the whole of those from the bladder. Mr. H. Fenwick ("Journal Anat.," xix., 1885) has shown that in the young subject all these veins are accurately fitted with valves, so that none of the blood from the rectum can enter them, and there can be no backward pressure in the vessels in the walls of the bladder. In later life, however, these veins, which even in the infant are of very considerable size, become more and more varicose, until at last they form an enormous plexus from which the valves have long since disappeared and through which the blood circulates with extreme slowness. Congestion therefore, is of common occurrence, and is often followed by thrombosis. It is the exception not to find phleboliths somewhere or other, and often long chains of them, around the prostate in elderly subjects. Normally the whole of the blood from this region returns through the radicles of the internal iliac, but in later life there is a free communication between this plexus and the rectal veins.

MINUTE ANATOMY.

The glands are of the compound tubular type. The ducts, forty or fifty in number, short and wide, converge from the lateral lobes to the floor of the prostatic sinus on each side of the veru mon-

tanum. Those from the median portion open as already mentioned above this, between it and the vesical orifice. Many of them run some little distance downwards in the wall of the urethra before opening into it. In most places they have no wall of their own, but are mere channels in the stroma lined with low columnar epithelium. Here and there, where, for instance, they traverse the mucous membrane, they are surrounded by a thin layer of fibrous tissue, but in no part are there any muscular fibres, transverse or longitudinal, belonging to them. In the infant the ducts constitute the whole of the glandular part.

The secreting tubules appear in section as groups of rounded spaces lined with a single layer of tall columnar cells. These rest upon a basement membrane in which there are a few nuclei. Between the cells, at their attached ends, are, according to Langhaus, a number of small pear-shaped ones which Griffiths describes as ultimately becoming columnar. The spaces communicate with each other freely, and groups of them unite together to open into the commencement of the smaller ducts. These in their turn converge to form the main ones.

The stroma.—Unstriped muscular fibres of unusual size are grouped around the terminal alveoli. In many parts the interspaces appear to be completely filled by them, without their forming definite layers. In the young adult they are especially distinct, fusiform in shape, rather short and broad in proportion to their length, with large ovoid nuclei. Later in life they are largely replaced by fibrous tissue.

The rest of the stroma consists of firm and dense connective tissue, with a few unstriped muscular fibres scattered through it. Under the capsule they are so numerous as almost to form a distinct layer.

In front of the urethra is a great transverse bar of stroma. Behind, except at the apex of the gland, is another almost equally thick, but not so wide. From both of these branching strands radiate obliquely outwards, interlacing with the glandular tissue and meeting the prolongations inwards from the capsule.

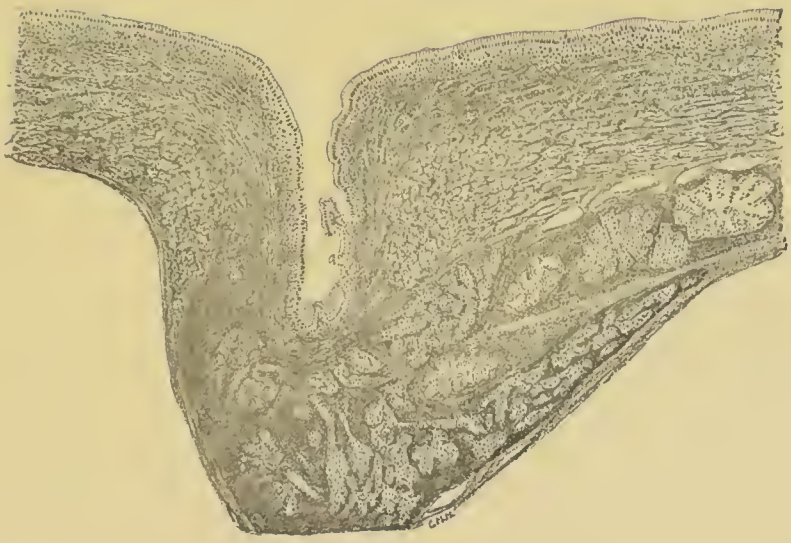
The stroma of the prostate, like the glandular tissue it supports, belongs to the sexual organs. In its histological features and in its origin from the genital cord it resembles the tissue that surrounds and forms the wall of the vesiculæ seminales. If a sagittal section is made through the neck of the bladder and the

prostate after they have been hardened in spirit, the stroma of the latter can be seen to be independent both of the circular muscular coat of the bladder and that of the urethra. In function it is entirely distinct. It does not aid in the expulsion of the urine. That, so far as the prostatic portion of the urethra is concerned, is carried out by the circular layer of muscular fibre immediately around it. It has to do solely with the discharge of the prostatic fluid, and, as Dr. Griffiths (*loc. cit.*) has shown, its development varies with that of the sexual organs. After castration it wastes as rapidly as the gland tissue.

Dr. Griffiths regards it as merely part of the circular muscular fibre of the urethra. "At the level of the veru montanum, in the prostate of a fœtus of nine months, this circular coat is seen as a continuous sheet along the anterior wall of the urethra, whereas at the sides and posteriorly it spreads out in slender fasciculi, which invest the developing tubules of the prostate. It undergoes a special thickening in this region behind the veru montanum, where the developing tubules of the prostate grow out from the urethra, and the fasciculi derived from this part and accompanying the tubules in their divisions constitute the muscular element of the prostate. Thus the muscle fibres and gland tubules grow on together, the former accompanying the latter in their whole extent, so that the muscle fibres form an investment to the gland tubules to their very extremities. The gland tubule growth, however, exceeds that of the muscle fibre, so that the glandular constituent forms a relatively and gradually increasing element of the organ. It is further to be observed that the ducts or excretory part of the prostatic gland tubules are devoid of a muscular investment. This results from the fact that these ducts occupy the situation near the veru montanum, between the mucous lining of the urethra and the circular coat, in which situation there is in the early fœtal state, a considerable quantity of connective tissue. Hence the developing ducts traverse this tissue before reaching the circular muscular coat of the urethra and acquiring from it their muscular sheath." For the reasons above given, however, I am unable to assent to this view, and am compelled to regard the stroma of the gland as independent of the circular muscular layer of the urinary apparatus and as much a part of the sexual system as the gland tissue.

The prostatic urethra extends from the vesical orifice to the

FIG I



Sagittal section through the neck of the bladder from an infant six months old (a little to one side of the median line), showing the structural identity and continuity of the prostatic stroma with the tissue surrounding the vesiculæ seminales and the vasa deferentia.

triangular ligament, from three to three and a half centimetres in length. Normally its walls are in contact with each other (except when urine is passing down) and its shape on transverse section is crescentic with the convexity forwards. The internal diameter is about eight or nine millimetres, but it is capable of great distension without being torn or bruised.

The mucous membrane, which is covered with low columnar epithelium, is loose and soft, and contains a large amount of elastic tissue with numerous longitudinal muscular fibres. According to Dr. Griffiths there is a thin layer of circular muscular fibre inside this. Outside is a well-marked circular coat, continued down from that of the bladder.

The veru montanum.—In the middle line running downwards from the vesical orifice along the posterior wall of the prostatic urethra is an elevation, the veru montanum. It begins very gradually just below the uvula vesicæ, descends for a centimetre and a half or two centimetres, rising slowly, and then suddenly widens out and comes to an abrupt termination. On each side of it is a depression, the prostatic sinus, on the floor of which are the orifices of most of the prostatic ducts. At its termination in the median line is a narrow slit, the opening of the prostatic utricle, and on the margins of this, one on each side, are those belonging to the ejaculatory ducts. The mucous membrane over it is peculiarly soft, with large thin-walled venous spaces in it, and is said to contain erectile tissue. Underneath are a great number of decussating muscular fibres, prolonged from the longitudinal muscular layer of the urethra.

The prostatic utricle, the homologue of the uterus and vagina in the female, is a minute sac lying between the two lobes of the prostate, and opening into the prostatic urethra by a small orifice at the inferior end of the veru montanum. It is developed separately from the prostate, and is merely included in it in the process of growth. The cavity is lined with a single layer of columnar cells (said by some to be ciliated), resting upon a layer of loose connective tissue, in which are numerous venous spaces. Outside are some scattered bundles of smooth muscular fibre running transversely. The ejaculatory ducts lie on each side of it, closely adherent to it, and open close to it in the prostatic urethra.

Henle's Muscle.—In transverse sections of the prostate about the middle of the gland a few striped muscular fibres are usually to be seen running across the front. Lower down these become thicker and

longer and form what is known as Henle's muscle, or the external sphincter of the bladder. At the apex of the prostate there is a very distinct layer surrounding the front and sides of the urethra immediately outside the unstriped circular layer; just below this it passes imperceptibly into the constrictor urethræ.

DEVELOPMENT.

The development of the prostate is of importance owing to the comparison that has been instituted between enlargement of the prostate on the one hand and fibroid disease of the uterus on the other.

The bladder and the first portion of the urethra, as distinguished from the prostate that surrounds it, are developed from the allantois, absolutely distinct from the rest of the genito-urinary passages. In the Monotremata they remain distinct; the penile part of the urethra, which is formed by the growth of the genital eminence on the anterior wall of the cloaca, in them never becomes organically united to the rest, or serves, as it does in the males of the higher order of mammalia, for the transmission of urine. As is the case with the corresponding organ in the female, it retains throughout life its purely sexual character. The same thing is sometimes seen in man, in cases where development has been arrested. In extreme forms of hypospadias, for example, the urethra opens in the perineum, and the penile groove is never closed in.

The Wolffian ducts become the vasa deferentia and ejaculatory ducts in the male, the ducts of Gärtner in the female. They open at first into the cloaca; later into that part of it which is marked off from the rest as the urogenital sinus. In some animals the ducts of Gärtner can be traced down the wall of the uterus and the vagina as far as the opening of the latter into the corresponding space, the vestibule.

Müller's ducts form the prostatic utricle in the male, the uterus and vagina in the female. As Bland Sutton has shown, the utricle corresponds to both uterus and vagina, and its orifice into the prostatic portion of the urethra to the orifice of the vagina into the vestibule.

The prostatic glands are described as originating from the mucous membrane that lines the urethra. If this were the case, they would be developed either from the allantois or from the urogenital sinus, which forms a small portion of the wall of the urethra below

the orifice of the utricle. In other words, they would be developed from the urinary organs, and have no connection with the vasa deferentia or any other part of the sexual system.

The difficulty is apparent only. The explanation is to be found in the shifting of the site of origin in the course of racial development. It has gradually been transferred from the lower end of the Wolffian ducts to the structure into which the ducts open.

In many mammals the prostate still retains its connection with the Wolffian ducts. It is attached to the distal end of the vasa deferentia and consists of two separate glands. In the human fœtus the lobes are still distinct; they lie behind the urethra, and even at birth their connection with it is much less intimate than it is in later life. Other organs change their point of origin in the same way. "The ureters, which are originally prolonged from and open into the Wolffian ducts, subsequently become shifted in position, so as eventually to open into the enlargement of the allantoic stalk from which the bladder is formed" (Schäfer). If reliance is to be placed upon the evidence of comparative anatomy there can be no doubt that the glandular part of the prostate has become shifted with the ureters a shorter distance in the same direction.

The stroma of the prostate is developed from the genital cord, a name given to the thickened mass of tissue that surrounds the Wolffian ducts as they course together to the cloaca behind the stalk of the allantois. The formation of this cord, according to Schäfer, is connected with the separation of the cloaca into a dorsal or anal, and a ventral or urogenital part.

The uterus, therefore, is homologous with part of the prostatic utricle, and in no way with the prostatic gland. The representative of this in the female is to be sought near the orifice of the vagina, where it opens into the vestibule, around the ends of the ducts of Gärtner, and that of the stroma in the same way, in the substance of the perineum. So far as the evidence derived from development and comparative anatomy is concerned, the homology that has been supposed to exist between enlargement of the prostate and fibroid disease of the uterus is based upon error.

THE FUNCTION OF THE PROSTATE.

The function of the prostate is entirely sexual. It assists the passage of urine by the mechanical support it gives to the urethra, and that this is of value is shown by the diminished thickness of

the circular muscular layer in the middle of the prostatic portion. It does not take any active share in micturition.

The thin layer of longitudinal muscular fibre, lying immediately under the mucous membrane of the first part of the urethra, continued downwards from the muscles of the ureters, helps by tending to level the surface of the trigone and obliterate the angle between it and the urethra, but strictly speaking it does not belong to the prostate.

Other surgeons hold a different opinion. Mr. Reginald Harrison, for instance ("Lectures on Surg. Diseases of the Urinary Organs"), considers that the chief use of the prostate is to act as a support to the bladder, and describes the muscular fibres of which it is composed as spread out like a funnel around the neck. In this Mr. Harrison follows the account given by Ellis ("Royal Med. Chi. Trans.," Vol. xxii.), who suggests the name "Orbicularis vel sphincter urethræ" for both the prostate and the prolongation around the membranous urethra. "This orbicularis may be considered as only an advanced portion of the circular layer of the bladder, though it must have the power of acting independently of the vesical fibres; whilst I would confine the old term, prostate (without the word gland), to the thickened and more powerful part near the neck of the bladder."

The sexual function of the gland is, however, amply proved by the evidence of embryology and comparative anatomy, and is established beyond doubt by experiment.

If castration is performed in early life neither the glandular nor the muscular part of the prostate is developed. If later, the prostate atrophies, and nothing is left but a small and hard fibrous nodule. In neither case is micturition interfered with in any way.

Dr. Griffiths (*loc. cit.*) has shown that, as with other sexual organs in animals, the size and perfection of the prostate (again both glandular and muscular parts) rise and fall with the breeding season.

Nor does the prostate in any way assist in micturition. It is only when the body is erect that it could act as a funnel-shaped muscular support to the bladder. Yet it is proportionately as large and as well developed in animals that maintain habitually the quadrupedal position.

Moreover in children, in whom the prostate is not developed, and in women, the absence of this support never gives rise to any difficulty.

The secretion of the prostate, according to Fürbringer ("Berlin Klin. Woch.," July 19th, 1886), is a thin, slightly milky, acid fluid containing an emulsion (not of fat, but of lecithin; Posner) suspended in an albuminous medium. It is discharged into the prostatic urethra with the semen. If it is wanting, the semen fails in its characteristic odour; no Böttcher's crystals can be developed from it, and the spermatozoa, though living, are motionless.

Fürbringer arrived at the conclusion that its function was to arouse and maintain the slumbering vitality of the spermatozoa. He obtained the secretion of the testes, mixed with that of the vesiculæ seminales, from a patient who was under his care suffering from atonic spermatorrhœa. The semen that escaped during micturition or defæcation was entirely deficient in the qualities above mentioned. That, on the other hand, which was discharged after sexual excitement was normal. The difference he attributes to the absence in the former case of the prostatic secretion.

Further experiments made with the fluid yielded in his hands corroborative results. Small quantities excited to action motionless spermatozoa; larger ones killed them, probably from excess of acidity.

A peculiar structure, described by Lataste ("Ann. de la Société de Biologie," Paris, 1886) as the "bouchon vaginale," is found in the vagina of certain rodents after copulation. It is a gelatinous body, moulded to the interior of the cavity in which it lies, secreted, except perhaps so far as its external layer is concerned, by the accessory male organs of generation. It liquefies on exposure to air and coagulates and becomes opaque on the addition of water. It is worthy of note that semen, after normal ejaculation, reacts in the same way; when it escapes in atonic spermatorrhœa, and, therefore, is probably not mixed to any extent with the prostatic secretion, it is diffluent from the first.

The terminal secreting tubules of the prostate in all men over fifty years of age contain minute spheroidal or (where several are in contact) polyhedral bodies, concerning the nature of which there is a certain amount of doubt. They exhibit a concentric marking, as if formed by deposition upon a central nucleus, in successive layers, and consist of an organic substance mixed with a variable amount of carbonate and phosphate (bone phosphate) of lime. When small they are yellow, almost translucent, and strongly refract light. The older ones are darker and more

opaque. According to Sir H. Thompson, the proportion of inorganic matter varies from 46 per cent. in the smaller to 86 per cent. in the larger ones. In one case under my care, in which they were especially large, the percentage was higher still. The nucleus may be formed either of detached epithelial cells or from the secretion, which contains a mucoid or nucleo-albuminous substance and a considerable quantity of phosphate. The subsequent growth is undoubtedly due to the deposition round the central body of material secreted by the cells. From the extreme frequency with which these bodies occur, with or without enlargement of the gland, they may be regarded almost as one of its normal constituents.

The stroma of the prostate has to effect the discharge of the secretion from the gland tubules into the urethra, where it mixes with the fluid from the testes and the other sexual glands. "The secretion is retained in the tubules where it is being formed, but especially is it retained in the parts of the tubules nearest to the urethra, which are usually larger. Therefore there exists in this gland the simplest and, at the same time, the most primitive means for retaining its secretion until a demand for its expulsion into the urethra arises. The secretion thus accumulated is expelled into the urethra during the sexual act by means of the contraction, which begins at the distal end of the tube, of the complete and continuous sheath of non-striped muscle that surrounds each tubule in its whole length" (Griffiths, *loc. cit.*). The secretion is in all probability a more or less continuous act throughout adult life. The discharge, at least of any amount, can only take place at long and irregular intervals. A considerable quantity must, therefore, accumulate in the tubules and the short, but wide ducts, and the function of the peculiarly arranged muscular fibre is to secure the expulsion of the whole of this practically at the same instant.

From an observation of Mr. W. Anderson's, it may also be part of the work of the muscular fibre of the prostate to prevent the regurgitation of semen into the bladder. This sometimes occurs in cases of chronic inflammation of the prostate, owing in all probability to enfeebled action of the muscular fibres in the upper part of the gland near the neck of the bladder.

Finger, who describes the ejaculatory ducts as surrounded through their whole length by a layer of circular muscular fibre, regards the prostate as a kind of sphincter for them and for the vesiculæ

seminales, in addition to its other duties. In chronic prostatitis the muscular fibre fails, and true spermatorrhœa occurs, the seminal fluid escaping into the prostatic urethra whenever there is an increase in the abdominal pressure, as in micturition or defæcation ("Medical Fortnightly," April, 1893).

The caput gallinaginis.—The function of this structure, which contains a certain amount of erectile tissue, is said to be to cut off the urethra from the bladder during coitus. There is no doubt that it is functionally connected with the generative act, more especially with ejaculation. Irritation or inflammation of this part of the prostatic urethra leads to priapism and precipitate emission. Atrophy and induration causes impotence, with absence or considerable diminution of sexual sensation, and in extreme cases complete failure of ejaculation (Finger, *loc. cit.*). It may, therefore, serve to prevent regurgitation (though this is with greater probability effected by the contraction of the muscular fibre in the base of the prostate and around the neck of the bladder); but it certainly has other duties. In connection with this it is worthy of note that it occupies the situation, and may, therefore, be the modified representative of the male organ for intromission in many of those animals which, like the Urodelous amphibians, retain the primitive cloacal outlet, such as exists in the human fœtus at an early period of life.

The relation of the prostate to the sphincter of the bladder.—Guthrie ("Anatomy and Diseases of the Urinary Organs") long since pointed out that the muscular sphincter of the bladder was at the end of the prostatic portion of the urethra, not at the so-called neck of the bladder. Fluid that enters the urethra anterior to the constrictor urethræ escapes by the penis; that which enters posteriorly, when it has filled the prostatic urethra, regurgitates into the bladder.

The bladder, when empty, is flattened from above downwards; the walls are in contact, and the cavity is obliterated. As urine enters, little by little the bladder expands, the muscular coat keeping up a slight tonic contraction on the contents. When a certain point is reached the tonic pressure of the muscle, distributed over the body of the bladder, overcomes that of the muscle around its neck, and the elastic resistance there as well. If the bladder is healthy this does not occur until it is distended; if it is inflamed, or the urine is irritating, it may occur with only a few drops.

Then the urine enters the prostatic portion of the urethra, and at once causes a desire to micturate. In infants micturition follows immediately as a reflex act. In adults, Henle's muscle and the constrictor urethræ, which being voluntary muscles the infant has not yet learned to use, are called into play.

Up to this there is a close parallel between the mechanism of micturition and that of defæcation. Here it stops; for the unstriped muscular fibre of the bowel, if the stimulus continues, can overcome the voluntary sphincter; while in the bladder the muscular coat is the weaker, and becomes tired out first, so that retention follows. Later, of course, when the elastic tension of the wall is called into play, the sphincter relaxes sufficiently to allow the urine to escape drop by drop.

So long as the bladder contains only so much urine as it can accommodate without exciting the tonic contraction of its muscular coat the internal orifice is closed. When this point is overstepped urine enters the prostatic part of the urethra, and this becomes physiologically (as it is embryologically) part of the bladder. "If we introduce an elastic catheter into the urethra of a man who has as yet no desire to urinate, until the urine begins to escape, and measure the portion of the catheter thus inserted, and then do the same thing with the same subject, when the bladder is full and desire is present, we always find that in the latter case the length of catheter necessary is from two to three c.m. shorter, and that as a matter of fact the urethra is so much shorter with a full bladder. Repeated experiments, carried out on healthy persons, showed that with a moderately full bladder the urethra was eighteen to twenty-one c.m. long; with a full bladder and a desire to urinate it was sixteen to nineteen" (Finger, "Med. Fort.," Chicago, 1893).

Confirmative evidence may be obtained both in animals and in man by injecting plaster of paris through the ureter into the empty bladder *post mortem*. If only a small quantity is injected under light pressure the vesical orifice remains closed, and the cast is egg-shaped. If the quantity is larger and the pressure greater the plaster forces its way into the prostatic part of the urethra, and the cast becomes pear-shaped, the conical part representing the first portion of the urethra dilated and physiologically forming part of the bladder.

Probably much of the discrepancy of opinion that exists with regard to the existence of a sphincter has arisen from the different

condition of the bladders that have been examined. It is undoubtedly true that, as a result of continued irritation, the circular muscular coat may become so hypertrophied as to form a kind of sphincter; and in cases of enlargement of the prostate in which there has been much spasm for some length of time an immense degree of thickening, most marked around the neck, is not infrequent; but nothing deserving the name of a sphincter is to be found in this situation in the healthy bladder of a young adult.

CHAPTER II.

THE ENLARGED PROSTATE.

Histology—Rate of Growth—Prostatic Tumours—Physical Characters—Varieties of Enlargement—Influence upon the Urethra—Frequency with which Enlargement Occurs—Frequency with which the Different Portions are Enlarged.

By enlargement of the prostate is understood a more or less uniform increase in size which not unfrequently makes its appearance as age advances, and which is in many instances associated with grave impairment of the function of the bladder.

It is not inflammatory. The course that it pursues, the symptoms to which it gives rise, and the histological changes it undergoes are entirely different from those that occur in inflammation.

Nor is it mere hypertrophy, compensatory or otherwise. The structure and arrangement of the tissues present material differences even in the earliest stages.

It is essentially a fibro-adenomatous growth, resembling in some measure the normal structure of the gland, not spreading through the sheath, but extending upwards in the mucous and submucous coats of the urethra and bladder.

The physical characters depend upon the rate of growth and the relative proportion of the fibrous and glandular elements. If the latter is small in quantity and soon degenerates, and if the growth is limited, or almost limited, to the natural boundaries of the gland, the shape is but little changed, and the size is scarcely increased, but the density may be extreme. If, on the other hand, it spreads widely, invading the bladder, and if the tubules become dilated into cysts with little fibrous tissue between and around them, the prostate may attain an enormous size, and grow out into lobes that project all round the vesical orifice and fill the lower part of the bladder. Masses the size of a cocoanut have been described.

Histology.—So far as I have been able to ascertain, in the specimens that I have examined, the primary change is the growth of imperfectly formed glandular tissue, recalling the tubular glands of

the prostate, but without ducts and without arrangement. It may spread from the lateral lobes, causing them to increase enormously in size, or from the median, or from all three together. Or it may make its first appearance separately from any of these, in the submucous layer of the urethra, originating, in all probability, in some of the small detached glands. Whatever its source it spreads upwards, for in this direction there is least resistance, and, though to a less extent, outwards. After a while the tissue loses its glandular character, and is replaced by a dense fibrous growth.

The tubules for the most part have an open lumen, and are lined with a single layer of low columnar cells, resting upon a basement membrane. Occasionally there is a tendency to the formation of acini, and sometimes these are so large that they deserve to be called cysts. Nowhere is there the orderly arrangement characteristic of the normal gland. The primary change is the invasion of the surrounding tissues by this adenomatous growth. The rate of increase may be rapid and irregular, leading to the formation of outlying bosses and nodules, perhaps far away from the parent mass and almost isolated from it, or it may be slow and uniform, so that the gland enlarges equally in all its dimensions. Wherever I could find the beginning it has always been the same.

The stroma at first takes but a small share in the enlargement. The tubules elongate and multiply; some of them grow out into cysts filled with a fluid that coagulates in spirit, but in the early stages, and throughout if the growth is rapid, the stroma forms but a small proportion of the increase. There are merely a few long fibre cells with large oval nuclei arranged concentrically around the imperfectly formed tubules.

In the older part, especially in the neighbourhood of the urethra, the glandular tissue is no longer to be found. The cysts and tubules degenerate into groups of cells lying in clefts and interspaces. The bulk of the growth is made up of a dense fibrous stroma, scarcely showing a trace of muscular tissue or of definite arrangement. Sometimes this fibroid transformation occurs at a very early period, and the growth never attains any dimensions; sometimes, on the other hand, the whole structure appears to retain its adenomatous character.

The rate of growth may be uniform; much more frequently it is very irregular. A group of tubules with the stroma that surrounds them increases out of all proportion to the rest. For a

short time the glandular tissue is in excess. Soon it becomes compressed and flattened, and the cells undergo fatty degeneration and disappear. Meanwhile the fibrous tissue becomes thicker and denser, and at length it grows into a hard rounded mass, with a concentric structure, separated by the way in which it has developed from the tissues around it, and exerting such pressure upon them that if exposed on the surface of a section through the gland it starts out from its bed of itself.

These are the so-called "prostatic tumours" which are held by Sir H. Thompson and many others to be analogous with the fibroid tumours of the uterus. They occur in greater or smaller numbers in nearly every case of enlargement of the prostate. "These tumours do not appear to affect any particular part of the prostate more than another, and may be found in any part of it. Perhaps they are more numerous in the lateral lobes, especially at their posterior extremities, than elsewhere. Occasionally they are embedded in an enlarged median portion. It often happens that the small multiple eminences so frequently seen at the neck of the bladder, in the site of the uvula, are due to these small tumours, there situated under the mucous membrane and a few submucous fibres, there being no enlargement of the median portion. . . . Rarely they are found in the anterior commissure of the prostate. Sometimes they appear just under the capsule, and so spring from the surface, carrying in an outward direction the capsule as a covering, but nevertheless escaping altogether the contour of the gland and looking almost like an independent or outlying formation. Occasionally they are really outlying, *i.e.*, separated by an interval from the prostate itself. A space of half-an-inch has been seen to intervene between such a tumour and the adjacent gland, a narrow line of ducts with other vessels and a little tissue alone connecting them" (Sir H. Thompson, "Diseases of the Prostate").

The size of these little masses varies from that of a hemp seed to a hazel nut. In many instances they are completely isolated from the structures around, but sometimes they are still connected over a wider or smaller surface, and they always appear to be under pressure, so that when a section through the gland is made their cut surface projects above the general level. Socin (Billroth and Pitha, iii., II., 39) described them as adenomyomata, but they contain very little muscular tissue. There are many long fibre cells which somewhat resemble unstriped muscle, but they are not

arranged like muscle fibres, and in all probability are of connective tissue origin.

These growths, however, are not tumours at all in the proper sense of the term. They are merely pronounced local enlargements, passing through the same changes as the rest of the gland at a more rapid rate. True myomata do occur in the prostate at times, as Griffiths has shown, but they are entirely different.

The peculiarly isolated character which enables them to be shelled out so easily by pressure is simply the result of their mode of growth. I have on several occasions met with similar rounded isolated masses, denser than the surrounding parts, and as easily separated from them, in tumours, such as fibro-sarcomata, which possess somewhat of the same physical characters, and grow at unequal rates.

The growth of fibrous tissue in the enlarged prostate is often associated with marked alterations in the walls of the vessels, chiefly fibrous thickening of the intima and media. Such arterial change is well known to be accompanied in other organs as well as the prostate by fibrous changes in the tissues supplied, in the kidney for example, and it is considered by Ziegler and others to be the primary cause of the fibrous changes often observed in that organ (Griffiths, *loc. cit.*). It is to be noted, however, that the fibroid transformation which follows or accompanies the adenomatous growth in enlargement of the prostate is not merely fibroid degeneration, such as occurs in the kidney and other organs as a consequence of or in association with general arterio-sclerosis. As, for example, in the case of the so-called prostatic tumours, there is a very distinct augmentation in volume, increasing considerably the pressure upon the parts around, and though the result is not so conspicuous, the same holds good for the rest of the gland. The stroma does not grow so quickly as the tubules, and therefore is less in evidence at first, but there is actual growth, not mere degeneration, and finally when the adenomatous tissue disappears the stroma has increased sufficiently to take its place.

The adenomatous tissue is best developed and most conspicuous in that part of the enlargement which adjoins the bladder. The pressure caused by the increase in the dense fibrous tissue surrounded by a tough unyielding capsule leads to early obliteration of the tubules in other parts. The immense power of resistance possessed by the capsule in the neighbourhood of the triangular

ligament is very probably one of the factors that determines the upward direction almost universally followed by the enlargement.

Physical characters.—The prostate never grows downwards towards the triangular ligament, or invades that part of the urethra which is developed from the genital eminence; nor does it spread through its capsule, though isolated growths may carry this to an immense distance in front of them. When, therefore, it enlarges it raises the neck of the bladder from the triangular ligament, and alters the relations that it bears to the floor of the pelvis.

Size.—Sir H. Thompson considers that a weight of seven drachms fairly indicates that there is some enlargement when found in a subject over sixty years of age, though he has seen a prostate weighing less than six drachms which afforded unmistakable evidence of increase. Clinically the size can only be estimated by measurement of the urethra and of the prostate itself through the rectum. The length of the prostatic urethra is about 3 c.m.; if it measures 3·5 there is enlargement.

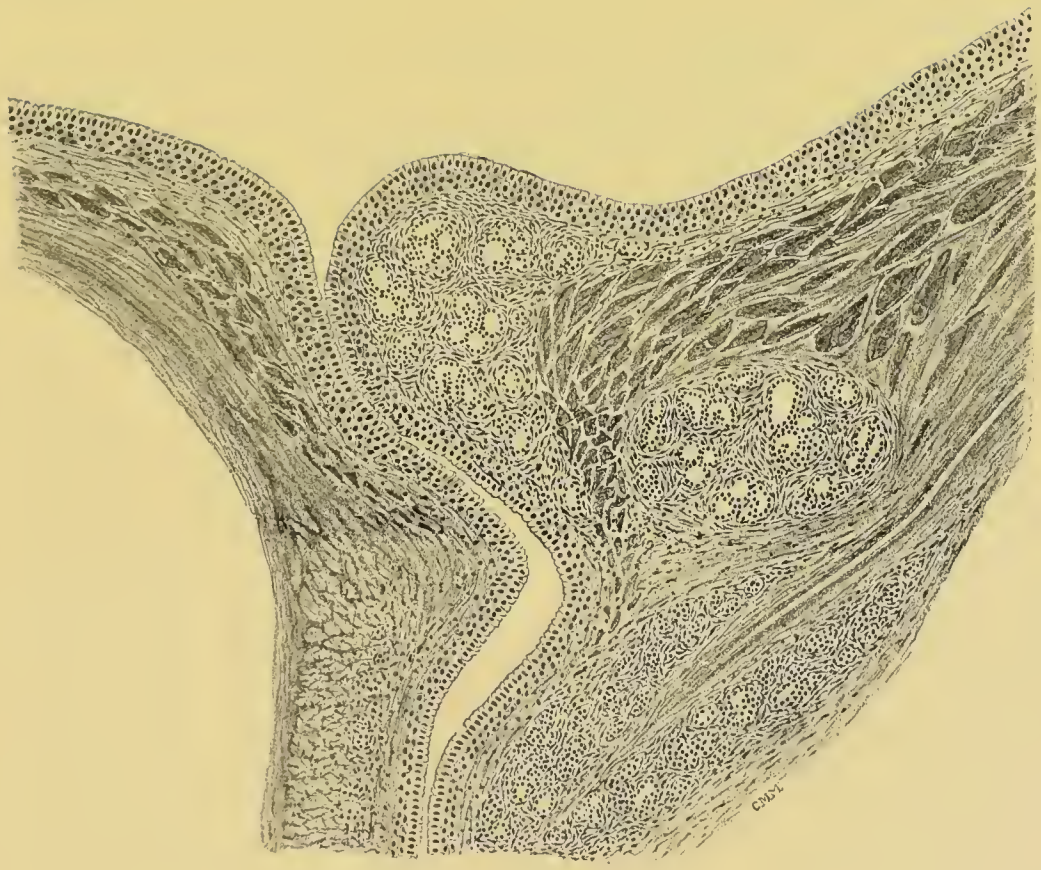
Both methods should always be employed. Occasionally in enlargement of the prostate the first portion of the urethra is dilated, and if a catheter is passed urine begins to flow long before the bladder is reached. Rectal examination in such a case corrects the mistake at once.

Shape.—The external shape of the prostate is altered when it enlarges. At first it becomes more uniform and rounded; the tension inside the capsule increases, and the cross section at the base becomes circular. Later it may become irregular.

The length is nearly always increased, sometimes so much that the finger introduced into the rectum cannot reach above it, and the first portion of the urethra measures seven or eight c.m.

The transverse and antero-posterior diameters are also increased, sometimes one, sometimes both, according to the direction of the enlargement. The notch between the upper ends of the lateral lobes behind is nearly always obliterated, and the groove that lies between the prostate and the bladder partly filled up. In extreme cases outgrowths of various shape and size make their appearance around the base of the gland, giving it an irregularly lobulated shape; but these are not nearly so common as the outgrowths that project into the urethra and bladder. Exceptionally they may be pedunculated.

FIG. II



Median sagittal section through the neck of the bladder of a man forty nine years of age, showing the growth of the adenoma up the posterior wall of the urethra into the neck of the bladder. Seen from the inside the vesical orifice was markedly crescentic in shape, as if the median lobe were projecting forwards into it.

Varieties of enlargement.—The shape of the interior and the relation that the gland bears to the neck of the bladder and the first portion of the urethra are much more variable.

1. The lateral lobes only may be enlarged. Usually they form two great ovoid masses, one on each side of the urethra, with their inner surfaces flattened, or even slightly convex, where they face each other. The prostatic urethra is reduced to a cleft between them, measuring from fifteen to twenty m.m. antero-posteriorly. At the posterior end it may be a little wider, owing to the projection into it of the veru montanum. The distance of the vesical orifice from the triangular ligament may be merely increased without the shape or the plane being altered, or the upper ends of the lobes may project upwards, one on each side of the opening into the cavity of the bladder. When this occurs they usually lift up between them a fold of the mucous membrane, and raise the orifice above the level of the trigone. When one lateral lobe, as is not uncommon, is enlarged to a greater extent than the other, the urethra is deflected towards the side of the smaller; and when their surfaces are nodulated from the projection of so-called prostatic tumours it may become very tortuous and irregular.

2. The enlargement may begin in the anatomical median lobe. If the growth is limited to this the shape of the vesical orifice and the distance between it and the triangular ligament may not be altered, although the latter is usually slightly increased. The enlargement lies behind the urethra, outside and beneath the circular muscular coat of the bladder. As it increases it spreads backwards, below the trigone filling up the notch between the two lateral lobes, and giving the posterior surface the characteristic rounded outline of the enlarged gland as felt through the rectum. Usually it presses forwards into the urethra as well, carrying the veru montanum in front of it, so that the cross-section of the canal becomes tri-radiate.

3. The enlargement may begin at the orifice of the bladder, in the posterior median line. At first sight this may be taken for a protrusion from the median lobe; it is, however, entirely distinct. The cause of the enlargement is an upgrowth of adenomatous tissue in the submucous coat of the urethra at its junction with the bladder. Between this and the median lobe there is the layer of circular muscular fibre prolonged down on to the urethra from the bladder. The median lobe may or may not be enlarged at the same time. Sometimes it can be seen in a sagittal section, lying by

itself. In the later stages it is lost in the mass that is developed in the posterior wall of the urethra.

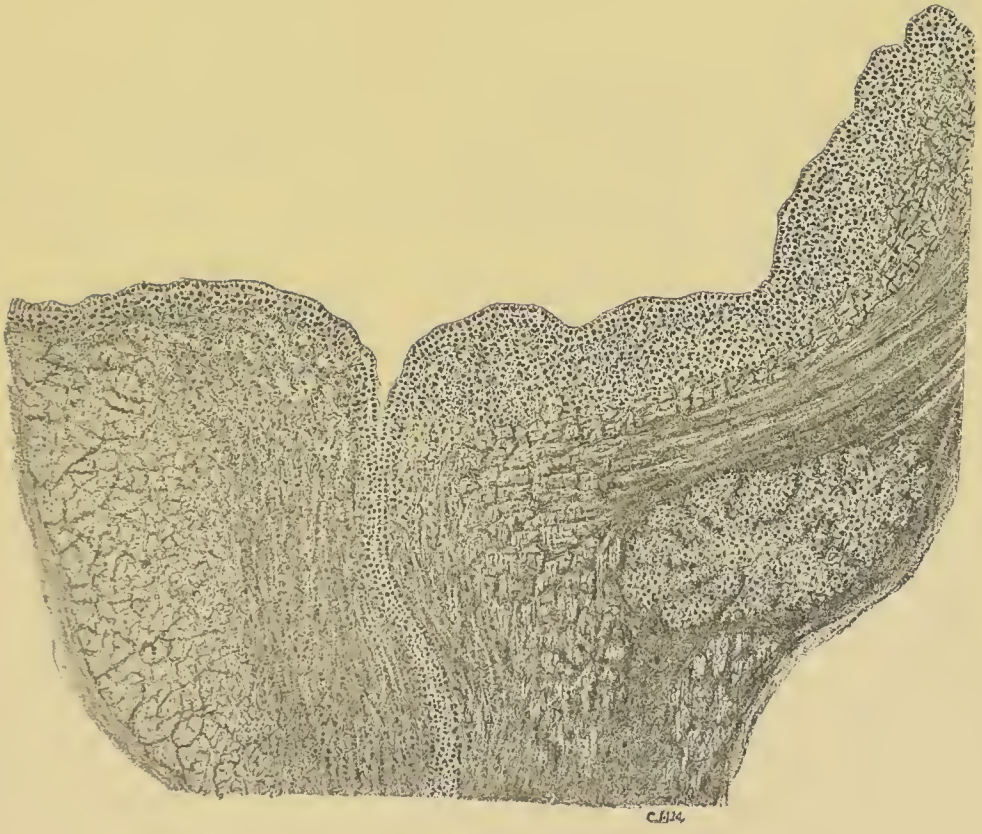
The size and shape of this growth have a very important bearing upon the outlet from the bladder. Even when quite small it raises this, and makes it crescent-shaped instead of circular. As it gets larger the posterior lip becomes thicker and more prominent. Then it grows out into a rounded sessile mass behind the opening; and at length, as it projects more and more, it forms a pedunculated lobe, which is often regarded as a product of the enlarged median portion.

In other cases the adenomatous tissue not only grows up behind the orifice, but extends around it as well. A thick semi-circular or horse-shoe shaped rampart may be formed in this way; and this again may grow out into lobes, especially if it is associated (as it usually is) with upgrowths from the enlarged lateral lobes below. Sometimes there are two of these upgrowths, one on either side; sometimes there is a third behind as well; and they may attain a very considerable size, and meet together over the orifice, so as almost to cover it when the bladder contracts.

Occasionally the elevation around the orifice forms a complete ring, the adenomatous growth having spread to the front from the sides, or extended up the anterior wall of the urethra from below. Exceptionally the anterior lip is thickened by itself, or grows out into a sessile or even a pedunculated mass. In extreme cases not only the margins of the orifice, but the surface of the trigone and the contiguous parts of the interior, are covered with growths of various shapes and sizes, usually more or less rounded, sessile, or with pedicles of different degrees of thickness, according to the extent to which they project. Masses the size of a Tangerine orange may be seen in every museum, and specimens as large as a cocoa-nut have been described. Whenever they occur they always lie on the inner surface of the muscular coat, covered over only by mucous membrane.

Whether an anatomical median lobe exists or not is, so far as these outgrowths are concerned, entirely beside the question. In the specimen from which Fig. 2 was taken there was a median projection at the junction of the bladder with the urethra, and the orifice was crescent-shaped instead of circular. But this was due to an entirely independent growth of adenomatous tissue in the mucous and submucous layers. The median lobe, which happened

FIG. III.



Sagittal section through the neck of the bladder, from a patient aged sixty-nine. The growth has extended up both the anterior and posterior walls of the urethra, and has reached quite to the back of the trigone. The muscular fibres around the neck are somewhat hypertrophied, and there is an indication of a commencing post-trigonal pouch.

croscopic section through the new growth, taken from the posterior boundary of the trigone of Fig 3. It shows the peculiar character of the adenomatous tissue, composed apparently of irregularly arranged tubules, each with a basement membrane, a single layer of low columnar cells, and a few long fibre cells on the outer side, and here and there bundles of muscular fibre surrounded and isolated by the new growth

also to be slightly enlarged, was quite separate, and some little distance off. Fig. 3 shows a more advanced stage from a patient 69 years of age. In this the growth spread not only up the urethra, but into the bladder. The whole surface of the trigone was invaded quite to its posterior limit ; and it was raised in such a way as of necessity to form a post-trigonal pouch. The microscopic appearance (Fig. 4, which is taken from near the base of the trigone) is almost the same. In places, however, the glandular tissue has invaded the muscular layer. Here and there, surrounded by newly-formed masses of adenomatous tissue, are a few scattered bundles of muscular fibre. The circular muscular coat of the bladder is considerably thickened (it has had unusual work), forming a mass that spreads down into the urethra. The growth in question lies on its inner surface.

Influence of enlargement of the prostate upon the urethra.—The shape and direction of the prostatic portion of the urethra are differently affected in these cases. The length is always increased and may even reach seven or eight c.m.

So far as the lower half is concerned the lateral lobes are the dominant force. If they are enlarged the urethra is compressed from side to side, and slightly elongated. The cavity may be reduced to a narrow slit, and the walls so closely pressed together (especially when there is any congestion) as to present a serious obstacle to the passage of the urine. In the upper part, nearer the bladder, their increase has not so much influence.

Enlargement of the median lobe by itself leads to widening of the transverse diameter with protrusion of the veru montanum. The lateral lobes have but little effect upon this ; they merely regulate the length of the anterior of the three rays into which the cavity of the urethra is compressed.

When there is an upgrowth of adenomatous tissue in the posterior wall of the urethra, not only is the length increased, but the direction and shape are materially altered. The orifice of the bladder is carried forwards, the urethra no longer follows a uniform curve, and a sharp angle is developed under the projection. An ordinary metal catheter gliding along the posterior wall is stopped, and requires either to have the handle depressed or the curve increased before the point can ride over it.

When this upgrowth is accompanied by uniform enlargement of the median and lateral lobes it sometimes leads to permanent dilata-

tion of the prostatic urethra. As it grows it spreads forwards and outwards as well as upwards into the bladder, and holds the sides of the urethra apart. If they are soft and flaccid the canal collapses, and merely its shape and direction are changed. If, on the other hand, they are dense and rigid, and especially if the median lobe below is enlarged, so that the sides below the growth are held apart as well, the canal is kept open and a permanent cavity formed. This space is often capable of retaining several drachms of urine, and sometimes is of such a size that a short-beaked sound can be rotated in it without difficulty. I have known it, owing in part to its distance from the meatus, mistaken for an empty and contracted bladder.

As the true sphincter of the bladder is situated lower down, at the apex of the prostate, incontinence of urine does not occur in these cases, as might have been expected.

In one patient, however, under my care, in whom this condition was present, and who ultimately died from slowly progressive softening of the brain, true incontinence did make its appearance towards the end of life. The urine dribbled away, so that the bladder, which had been able to retain as much as fifty ounces, never held more than five or six. In this instance the sphincter ani was paralyzed as well.

Possibly this may have been the explanation in Mercier's four cases, in which the bladder was found empty and contracted post-mortem, while the prostate was enlarged and the internal meatus patent. In any case, however, as Sir H. Thompson has pointed out, true incontinence such as this is a very rare event.

The frequency with which enlargement occurs.—According to Sir H. Thompson enlargement of the prostate is met with in about one-third of the number of those who pass sixty years of age. The proportion, however, of those who suffer from it is very much smaller, probably not more than one in ten.

Frequency with which the different portions are affected.—It is very difficult to form an idea of the relative frequency with which the different portions are affected. Museum specimens are of little help. They are nearly always collected with a definite object, because the disease they illustrate is rare, or there is some special interest attached to it, or the specimen presents some unusual feature. And nearly always they illustrate only that stage of the disease which is no longer compatible with life, very rarely the

beginning or even that period in which there is hope of operation or palliative treatment.

Vignard ("De la Prostatomie et de la Prostatectomie," Paris, 1890), analyzing the specimens in Civiale's Museum, with the view of ascertaining the frequency with which an isolated valve-like growth occurs, classifies them as follows:—

General hypertrophy, without distinct obstruction at the neck...	10
With a distinct valvular growth...	9
	19
Hypertrophy of the lateral lobes only	
Partial hypertrophy, limited to the neck...	
	28

General hypertrophy, therefore, being present in (approximately) 68 per cent.; a valvular median outgrowth by itself in only 11 per cent.; and in conjunction with general hypertrophy in 32 per cent. As Vignard points out, these statistics require to be taken with a certain amount of caution, as it is probable that specimens exhibiting hypertrophy of the median lobe would have been preserved to the exclusion of others from the interest attached to them.

Watson, on the other hand ("Operative Treatment of the Hypertrophied Prostate"), states that out of thirty cases that he figures the median enlargement formed the chief obstacle to urination in twenty-seven, and in ten out of thirty absolutely the only one.

Median and lateral hypertrophy...	14
Median hypertrophy only	9
Lateral hypertrophy only, with or without a bar connecting the lateral lobes	4
Hypertrophy of median and one lateral lobe	2
Separate pedunculated tumours...	1
	30

Vignard, therefore, in a series of favourably selected museum specimens (in all of which there had been retention) finds that in only 43 per cent. is there a median (or lateral) tumour or valve at the neck causing obstruction. Watson describes the median enlargement as forming the chief obstacle to urination in no less than 90 per cent.

Watson's results agree much more closely than Vignard's with

those published by Sir H. Thompson, drawn from four of the principal museums in London, and with those of Dittel. It is interesting that they all agree in regarding lateral enlargement by itself as forming a very small proportion of the whole.

It is probable that urinary symptoms were present during life in the majority of these cases, if not in all.

Statistics drawn from cases of enlargement of the prostate taken indiscriminately without reference to urinary difficulties agree with these fairly well. I have examined over a hundred taken in this way, and find that in at least four-fifths all parts of the gland are affected to a greater or less extent. The lateral lobes often show it least, because of the amount of fibrous stroma they contain, but their minute anatomy leaves no doubt as to the alteration they have undergone. It is the exception to find definite enlargement of one lobe without the rest being involved to some extent.

Evidence of this kind, however, is of little value in the question of treatment. The majority of cases of enlargement of the prostate present no symptoms. If any importance is to be attached to the relative frequency with which the various lobes are affected, only those cases should be considered in which difficulty of micturition is present.

In the Hunterian Lectures upon the Operative Treatment of Enlargement of the Prostate (1892), I published full details of all the cases of supra-pubic prostatectomy that had been performed up to that date, not only those that had already appeared in the medical journals, but many that were privately communicated to me by surgeons in England and America. In eighty-six of these the part of the gland that caused the obstruction and was removed is specified. In forty-three per cent. there was either enlargement of the whole gland, or a "collar" around the orifice; in another forty-three per cent. the median lobe only is mentioned; and in the remaining fourteen per cent. it is stated that the lateral lobes were in fault.*

* In these statistics, my own as well as those of other surgeons, I have, for the sake of uniformity, employed the term median lobe in its ordinary sense, viz., an enlargement under the mucous surface in the median posterior line. Probably in a large proportion, especially of those in which the overgrowth is described as taking the form of a collar, it was really an adenomatous outgrowth in the submucous layer, as described already, and had little or no connection with the anatomical median lobe.

The proportion of those in which median enlargement alone is mentioned is considerably higher, not only than it is in Vignard's, but in the other statistics also. It must, however, be remembered that they were cases in which an operation was performed to remove an obstruction, and, therefore, the investigation was not carried farther than was absolutely necessary, and that in many instances, even when the lateral lobes were known to be enlarged, the surgeon may not have mentioned it, considering that as they did not form an obstacle to micturition, and were not interfered with, their overgrowth had no bearing upon the case. The proportion in which median enlargement with as well as without that of the lateral lobes (86 per cent.) existed is strikingly like that in the series collected by Sir H. Thompson, Watson, and Dittel.

The main point is that in forty-three per cent. of cases that required operation the median upgrowth was found to be the sole obstructing cause, and in as many more a considerable factor in it.

CHAPTER III.

THE CAUSES OF PROSTATIC ENLARGEMENT.

The Time of Life at which the Enlargement Begins—The Analogy Between Fibroid Tumours of the Uterus and Enlargement of the Prostate—The Connection Between General Atheroma and Enlargement of the Prostate—The Theory of Compensative Hypertrophy—A Possible Solution in the Relation Between the Prostate and the Testes.

Of all the theories that have been brought forward to explain enlargement of the prostate, and they are very many, not one is satisfactory. Most of them have been disproved already, times without number, and these I shall not mention. There are three, however, supported by the weight of such authority that they cannot be lightly dismissed.

One is based upon a supposed analogy between prostatic enlargement and fibroid disease of the uterus. This was first suggested by Velpeau, and is supported by Sir H. Thompson, and Professor White, of Philadelphia.

According to another, enlargement of the prostate is merely one of the occurrences in a constitutional disorder that begins as arterial sclerosis and ends in fibroid degeneration, affecting the genito-urinary organs in an especial manner. This has the support of Guyon, and following him, the whole French School.

The third has been suggested by Mr. Reginald Harrison. According to this, the primary change is in the bladder; the enlargement is secondary to it, and developed as a compensatory measure.

The time of life at which the enlargement begins is a part of this question; for although old age is no longer regarded as a cause, there is a great tendency to speak of the enlargement as "senile," and to associate it with advancing years as one of the more or less likely events. In this matter it is especially necessary to distinguish the age at which the enlargement begins from that at which the symptoms it causes become so urgent that the patient is compelled to seek relief. There may be an interval of many years.

It is generally stated, on the authority of Sir H. Thompson, that enlargement of the prostate never occurs at so early a period as fifty-three years of age. There is no doubt, however, that although it is unusual for it to cause symptoms that would attract the patient's attention before then, the beginning may precede this by many years. McGill, for example (Brit. Med. Ass., August, 1889), pointed out that the ages of two of the cases in which he operated were fifty-three and fifty-four respectively; and in the last, where no source of fallacy existed, the enlargement must have been present at or before the age of fifty.

I have met with several such cases, some of them younger still. In one (from which Fig. 2 was taken) there was a distinct median projection into the neck of the bladder, due to glandular overgrowth, at forty-nine years of age. Another, who was only forty-eight, was under the care of Dr. Henderson, of Highgate. For some years he had been unable to empty his bladder without a catheter, and at the time that I saw him he was suffering from a typical attack of prostatic retention, caused by an enormous median lobe. A third, who was sent up to me by Dr. Walters, of Reigate, was only forty-one. In this case the mischief may have been exaggerated by attacks of chronic inflammation. However, on digital exploration through the perineum a distinct median lobe was felt, projecting into the urethra. For months before the patient had been unable to empty his bladder without a catheter; the median projection was divided freely, and six months later he had discarded his instrument, and could hold his urine for three or four hours without inconvenience. In another, whom I am attending at the present time, only fifty-three years of age, there is great dilatation of the prostatic urethra, showing that the enlargement is general, and therefore, probably of some duration, and in addition an enlarged median lobe, which occasionally falls over the orifice.

Many other similar cases at even earlier ages have been recorded by other surgeons. McGill, subsequently to his two other operations, in June, 1890, removed and identified as such a certain amount of prostatic tissue that was acting as an obstacle to the outflow of urine from a patient only thirty-five years of age (Mr. Moynihan, Leeds Gen. Infirmary). One of Teale's patients (Brit. Med. Ass., Aug., 1889) was only fifty-four. Meinhardt Schmidt's, at the time of the first operation, was only fifty-two, and the symptoms had already lasted a very considerable time. Packard

writes to me that in one of the cases mentioned in his paper on supra-pubic cystotomy, read before the American Surgical Association, there was a very large prostate projecting into the bladder, although the man was only forty-three. White, of Philadelphia ("Medical News," Oct. 13, 1890), found an enlarged and distinctly pedunculated median lobe in another patient of the same age. Belfield, of Chicago ("Amer. Journ. Med. Sciences," Nov., 1890), removed a mass the size of a walnut from the left lateral lobe of a patient forty-nine years of age, and he mentions several others—Dunn's, for example, in which a tumour was excised from the lateral lobe in a man of forty-five; Iversen's, in which the age was only thirty-six; and one by Mudd, of St. Louis, who exhibited at the Association of Urinary Surgeons in June, 1890, an enormously overgrown prostate, proved by microscopical examination not to be the result of malignant disease, taken from the body of a negro at the early age of twenty-seven.

When instances of this kind are met with in such numbers at such various ages, it is clear that senility has little or nothing to do with enlargement as a cause.

If this were the case the tendency to enlargement would increase, not perhaps in proportion, but still would increase as men grow older. This is not what is found. As Sir H. Thompson has shown, enlargement rarely commences after seventy. Where it exists the disease has generally made considerable progress before seventy or seventy-five. Consequently it is met with but infrequently in later years, and is exceptional after eighty or eighty-five. Sir G. Humphry states that of seventy-two persons between eighty and ninety, only seventeen, and of thirty above ninety, only one suffered from urinary troubles referable to enlargement of the prostate.

One deduction must be made from these figures. Enlargement of the prostate does not occur in all people; nor does it cause urinary symptoms in the majority of those in whom it does occur. Consequently it is possible that many who reached these advanced ages were among those who were exempt either from the disease itself, or the consequences to which it gives rise, and that those who suffered from it died at an earlier period because they suffered. Still, even when full allowance is made for this possible source of fallacy, it is a striking fact that extreme old age is, to a great extent, exempt.

On the analogy between the growth or growths which make up enlargement of the prostate and the fibromyomata of the uterus.—The view that these are analogous has received, and still receives, the highest support.

It was first suggested by Velpeau, on the ground that there was a striking resemblance between them in situation, structure, and mode of growth. The prostatic growths are fibrous tumours in exactly the same sense as the growths in the wall of the uterus are fibrous tumours of the uterus. They are developed in the substance of the prostate, and sometimes acquire a volume much greater than the structure from which they spring, like the growths in the uterus. They become pedunculated, and project into the cavity of the bladder precisely in the same way that the polypi of the uterus grow out into the cavity of the uterus; or they may project, just as these do, towards the perineum, the side of the pelvis, or the rectum.

Sir H. Thompson lends this opinion the weight of his authority not only for these reasons, but because the observations of modern anatomists confirm the view that the analogue of the uterus, or rather of the uterus and vagina combined, is in the male the prostatic vesicle or utricle. "The prostate, although not of itself the absolute equivalent of the uterus, contains in it the utricle, situated as this cavity is in the centre of the organ." The resemblance between the two organs in structure (they are both formed mainly of unstriped muscular fibre), the identical histological character of the growths (they differ only in the fact that the glandular part is more marked in the one than in the other), the close similarity in the relations that they bear to their respective organs (they may be encapsuled tumours, shelling out with ease, or polypoid outgrowths, or gigantic masses far exceeding in size the structure from which they spring), and the fact that the two organs are alike subject to considerable hypertrophic enlargement, with or without tumour formation, are all regarded by him as strong evidence in favour of close analogy. Moreover, the age at which these growths are most common is almost the same for the two sexes, if the difference in the duration of sexual life is taken into consideration; they are most frequent in the one as in the other during the latter half of the reproductive period; they seldom begin after this is past.

Prof. White, of Philadelphia ("Annals of Surgery," 1893), accepts this theory provisionally, and certainly there is more to be

said in favour of it than there is in favour of the others. But there are arguments against it which appear to me unanswerable.

It is not supported by the facts of development. The homologue of the uterus is not the prostate, but the prostatic utricle, an entirely independent structure, which is included in the prostate gland merely by an accident of growth, and which has never been shown to take the least active share either in tumour formation or in general enlargement of the prostate gland. The homologue of the prostate, if it exists in the opposite sex, is to be found in the perineum, near the lower ends of the ducts of Gärtner.

The histology of the growths does not support it. Uterine growths originate as fibro-myomata. They have little or nothing to do with the mucous membrane or the glands that it contains. Enlargement of the prostate, on the other hand, is glandular from the first; it begins and spreads as an adenomatous growth, and even the rounded masses that it contains, with few exceptions, originate in the glandular tissue.

Both organs, it is true, contain unstriped muscular fibre (though the proportion in which this is present and its arrangement and uses are exceedingly different), and the growths which originate in them resemble each other to a certain extent, it is true, in shape (they are usually rounded), and in relations (sometimes they are encapsuled, sometimes they assume a polypoid form), but these peculiarities are by no means confined to these organs or their growths. Unstriped muscular fibre occurs in abundance elsewhere; rounded encapsuled masses that shell out when they are exposed by section, are by no means rare in fibro-sarcomata; and tumours, when they project into the cavities of other viscera, not unfrequently become polypoid in shape.

That both these organs should be liable to tumour formation and enlargement during the latter half of the reproductive period, when the first flush of full sexual activity is over, is of great significance in many ways; but it is scarcely sufficient to recommend the adoption of this theory, even provisionally.

Enlargement of the prostate bears the same relation to the testes that fibroid disease of the uterus does to the ovaries. But the fact that they bear the same relation to two different organs is no proof that they bear any relation to each other.

On the theory that enlargement of the prostate is merely one of the events that occur in general atheroma.—According to Guyon

("Leçons Cliniques sur les Affections Chirurgicales de la Vessie et de la Prostate"), and Launois ("De l'Appareil Urinaire des Vieillards," Paris, 1885), enlargement of the prostate is not a local affection, or the cause in more than a limited degree of the changes in the structure of the bladder and the other urinary organs that accompany it. It is part of a general disorder of common occurrence in advancing age, characterized by the substitution of rigid fibrous tissue for active muscular and glandular structure; in other words, part of a general sclerosis affecting the genito-urinary organs in particular, and beginning in the vascular system, but not confined to it.

The prostate, so it is argued, becomes altered in structure. Hard, unyielding fibrous tissue is slowly but steadily substituted for the glandular part.

The bladder is affected in a similar manner. Hypertrophy of its muscular coat and condensation of its mucous and submucous ones are normal events of old age. As the structure of the prostate is altered that of the bladder is altered too. There is over-production of fibrous tissue, which spreads everywhere in the intermuscular spaces, and in the mucous and submucous coats. It increases more and more until at length great columns and ridges stand out from its surface.

The kidneys and ureters undergo a similar change. The cortex atrophies, and the capsule, or the vessels, or the glomeruli, or all together become thickened and hardened by the development of rigid fibrous tissue.

Everywhere throughout the urinary tract there is the same widely spread and general sclerosis. It begins in the vascular system as endo- and peri-arteritis, and is aggravated by repeated attacks of chronic and subacute inflammation. Everywhere there is the same change pointing to diminished vitality.

Selerosis precedes obstruction to the flow of urine and paves the way for the inflammatory changes that always follow. The arteries are the first to suffer, and the loss of force entailed by their rigidity leads to passive congestion and venous dilatation.

All other organs in the body suffer more or less in the same way. Enlargement of the prostate never occurs without general atheroma.

Enlargement of the prostate and failure of the muscular strength of the bladder are coincident events of the same disorder. The

one is not the cause of the other. Sometimes one is the more prominent, sometimes the other; and all the symptoms that are ordinarily regarded as the consequence of enlargement ("la prostatisme") may occur without enlargement. It follows that it is useless if not dangerous in a case of vesical atony to rush into all kinds of therapeutic measures that appear capable of waking up the contractility of the muscular fibres. These either no longer exist, or else are so weakened and compromised by sclerosis that they can no longer respond.

The evidence against this view, which would prohibit any but the simplest palliative treatment, is to my mind insuperable. It is true, as Sir Benjamin Brodie pointed out, that enlargement of the prostate and atheroma frequently occur together; the time of life at which they are both most common is the same. But this does not show in the least degree that the one is the cause of the other.

Enlargement of the prostate does not begin as fibroid degeneration, but as glandular overgrowth. Arterial sclerosis and passive congestion cannot cause this; and still less can they cause the growth of the masses that sometimes almost fill the lower part of the bladder.

Enlargement of the prostate is compatible with perfect health, and may continue even to extreme old age without its existence being known. Those who suffer from urinary troubles form but a small proportion of those in whom enlargement occurs. The vast majority are free, and though some may be atheromatous, many live on with no evidence of vascular degeneration other than that which is the normal accompaniment of healthy old age.

Enlargement of the prostate may be present and may have already attained considerable dimensions long before the age at which atheroma occurs; and, on the other hand, after a certain time of life, if it is not present already, it rarely begins.

Nor is it the case that enlargement of the prostate and loss of power of the bladder of necessity occur together. The bladder in a large proportion of cases retains its power in the face of even considerable enlargement. And if the enlargement is removed, and it is not too late, the bladder may regain the power it has lost. In what proportion this occurs I shall discuss later. Among the earlier cases it was said to be only in one-third of those in which supra-pubic prostatectomy had been performed, a proportion that is not surprising if the previous condition of the patient is con-

sidered for a moment ; but if it occurs at all it is sufficient. If the obstructing growth and the loss of power were both due to general fibroid degeneration and impaired vitality, removal of the one would have no effect upon the other.

On the theory that the primary change is in the bladder, and that the enlargement of the prostate is developed in compensation.—Mr. Reginald Harrison (Lectures on the Surgical Disorders of the Urinary Organs) regards the prostate as chiefly muscular, and sums up its structure as consisting of unstriped muscular fibre, in which a considerable amount of tissue engaged in secretion is embedded. The enlargement he considers is developed to compensate for the sinking into the floor of the pelvis of the posterior wall of the bladder. This is the primary change and one of the consequences of advancing years.

"I have long felt that the solution of the question (the cause of the enlargement) would probably turn on a further recognition of the function of the part involved, and that thus the urinary apparatus might furnish another instance of a compensatory contrivance to meet exigencies arising out of structural deterioration.

"We have not yet sufficiently recognized the use of the prostate as a muscular support—primarily to the bladder and its contents, and secondarily to the adjacent parts—a support which in the event of muscular tissue failing must be supplemented by other means and other tissues.

"Assuming that from any cause, such as long retention of urine, habit, position of the body, or weakness connected with advancing years, the floor of the bladder sinks lower within the pelvis, relatively to the prostate, so as to offer some difficulty in expelling the last portion of the urine, the effect will be frequently repeated efforts in all the muscles immediately adjacent to a part of the bladder, which, by reason of its connections and structure, has but little power of contracting. This will eventually lead, as I have endeavoured to show, to the development of a strong muscular buttress between the orifices of the ureters, and also, I believe, to similar changes in the muscular tissue so largely entering into the prostate and principally affecting its posterior segment.

"Quantity is substituted for quality, and as age advances structural deterioration is thus provided against."

The outgrowths which are so frequent and so large in connection

with enlargement of the prostate, Mr. Harrison accounts for as the upheavings of a frequently contracting muscular ring.

This theory, like the other two, is untenable. The prostate, both as regards its glandular substance and its stroma, is of sexual origin, and has to deal only with sexual functions. It develops with the testes, and atrophies if they are removed. It has nothing to do with micturition, which, if the prostate remains undeveloped or undergoes atrophy, takes place just as well as it does if the prostate is normal.

Nor is there any evidence that a sinking of the posterior part of the bladder is a primary change; nor that when it does sink the prostate enlarges in compensation. This can only be imagined so long as the erect position is maintained and the prostate bears the same relation to the bladder that it does in man, whereas enlargement takes place in dogs and other quadrupeds, in which the anatomical relations are entirely different.

The present state of our knowledge does not enable us to say why enlargement of the prostate is prone to occur at a particular period of life, any more than it enables us to say why fibro-adenomata so frequently occur in the breast shortly after its evolution at puberty, or why fibro-myomata so often make their appearance in the uterus towards the latter end of its active sexual existence.

That the normal development of the gland is dependent upon that of the testes is undoubted. That enlargement rarely begins in extreme old age, after it may be presumed the function of the testes has passed into abeyance, is highly probable. That the enlargement disappears within a few weeks after the testes have been removed is now proved (see Chapter XI.). Probably, therefore, this abnormal growth is in some way conditioned by the state of the master-organs of the male sexual system. In what way it is not possible to say. We know too little of the influence that one organ has upon the rest. Affections of the thyroid can produce the most profound structural alterations throughout the body. It is believed on experimental evidence that the pancreas has duties in connection with general nutrition entirely independent of its secreting action. There is reason to believe that the

condition of the ovaries has some influence in connection with mollities ossium; there are cases, at any rate, in which removal of the ovaries is stated to have been followed by recovery from this otherwise almost universally progressive disease. Removal of the uterine appendages, inducing the menopause prematurely, undoubtedly has an effect upon the growth of fibro-myomata of the uterus. And it may be that certain conditions of the testes usually occurring at that time of life (but sometimes earlier) may stimulate the prostate to increased and irregular growth.

Until we know more, it is better to admit our ignorance than to conceal it from ourselves by accepting, even provisionally, theories which we feel to be unsatisfactory.

CHAPTER IV.

THE EFFECTS OF PROSTATIC ENLARGEMENT UPON THE BLADDER AND KIDNEYS.

The Effect upon the Bladder—Increase in the Amount of Work—Impairment of Nutrition—The Influence of Congestion—The Effect upon the Kidneys—The Influence of Age and of Inflammation.

Enlargement of the prostate is always attended by changes in the condition of the bladder and the other urinary organs. The association is so constant that the one, there can be no doubt, is the cause, immediate or remote, of the other. Guyon, however, and following him the whole French School, regard them as coincident effects, dependent upon the same constitutional disorder.

The size and shape of the bladder are altered. It may be so small that it can hold only three or four ounces, or so large that it can contain as many pints. Its shape may be normal, or it may be conical, or pushed out into a great pouch behind, or studded with rounded sacculi. These sometimes consist of all the coats, but the largest and most numerous are formed of little more than the mucous membrane projecting under the serous layer from between the bundles of muscular fibre.

The inner surface may retain its natural colour, or it may be stained all shades from red to black by old and recent hæmorrhages. It may be smooth or marked by interlacing ridges caused by the thickened muscular coat beneath. The lozenge-shaped spaces between these may be mere shallow depressions, or they may lead, often by very narrow orifices, into sacculi, filled with stagnant and often decomposing urine. The epithelial lining may be intact and preserve its normal smooth appearance, or it may be roughened, ulcerated, and coated over with an offensive and tenacious mixture of mucus and phosphates.

The walls may be rigid and thickened by the growth of fibrous tissue, so that they can neither relax nor contract; or they may be thin and flaccid. In the earliest stages there is sometimes a

certain amount of true muscular hypertrophy, but afterwards power is always impaired. The muscular bands may undergo fatty degeneration and disappear, or they may grow out into great columns that project into the cavity of the bladder; but, as a rule, there is more fibrous tissue in these than muscle. Sometimes the mucous and submucous layers are stretched and thin. More often, especially when the bladder is small, they are thickened and indurated, or filled with varicose venous plexuses, which, in cases of retention, are plugged with thrombi in various stages of organization or decay.

The ureters and the pelvis of the kidneys suffer in a similar way. The mucous membrane is swollen and congested. In the later stages, when septic cystitis has set in, it becomes inflamed, and even ulcerated. The muscular coat is wasted, and, to a great extent, replaced by fibrous tissue. Sometimes the walls are thickened; more often they are thinned and stretched to an enormous size. The kidney itself is smaller and harder than natural; the capsule is adherent and puckered on the surface; the cortex is atrophied, and the general texture tougher and more resistant. Throughout there is wasting of the active muscular and glandular structures, and in their place passive and inert fibrous tissue, which contracts or yields and stretches according to the degree and persistence of the pressure that is brought to bear upon it.

These changes are met with constantly in association with enlargement of the prostate. They do not occur without it, or without some similar cause, such as calculus or neglected and inveterate stricture. In women, as might be expected, such conditions are rarely found.

The first effect of enlargement of the prostate upon the bladder is to increase the amount of work thrown upon its muscular coat.

The second is to impair the nutrition of all the coats by keeping them in a state of chronic congestion.

The outcome, supposing no complications set in, depends upon the amount of the work to be done on the one hand, and the strength and vitality of the tissues that have to do it upon the other.

1. *The increase in the amount of work.*

It does not matter what part of the prostate is affected. It may be the median or the lateral lobes; it may be all three, or it may

be the urethral portion only. Wherever it occurs, it obstructs the exit of the urine from the bladder, and increases the work.

Every form of enlargement, for example, interferes with the action of the neck of the bladder. As micturition begins, the first part of the urethra relaxes, dilates, and becomes physiologically, as it is genetically, part of the bladder. So long as the gland retains its normal shape and size, this takes place without difficulty. When enlargement begins, no matter what may be the shape (though some are much worse than others in this respect) or when the prostate, instead of enlarging, becomes hard and dense, expansion is checked ; the sides of the urethra remain in contact, and the amount of resistance the bladder has to overcome is increased.

Every form again interferes with the level of the floor of the bladder. Enlargement of the prostate is always accompanied by an increase in the length of the prostatic urethra, especially of its posterior wall, and this necessarily raises the outlet. Growth cannot take place downwards because of the triangular ligament. It must take place upwards, and carry with it the neck of the bladder. So far as the anterior portion and the sides are concerned, this is not of material consequence ; they too are raised, not so much perhaps, but sufficiently to prevent their becoming receptacles for stagnant urine. The posterior wall, however, stretching farther backwards, does not escape so easily. Its even gradual slope from above downwards is broken ; the apex of the trigone is raised, and the part of the bladder that lies behind it becomes the lowest and the last to be emptied. So long as the muscular coat is equal to the task this does not matter ; there is a little more work to be done in emptying the bladder, but if the tissues are healthy and not too old, they grow stronger and do it. If, on the other hand, the balance is upset, if the amount of resistance in front is increased too quickly, or if the strength begins to fail (and as Mr. Hurry Fenwick has shown the posterior wall of the bladder is thinner than the anterior), this part of the bladder, because it has most to do, gives way first, a certain amount of urine is left behind, and at length a pouch is formed.

The alteration in the shape and direction of the orifice has the same effect as the alteration in its position. In the child the opening is circular, and when the bladder is full and micturition beginning, funnel-shaped with shelving margins. As the growth invades

it, it becomes bent into the form of a crescent, the posterior lip enlarging and pressing forwards into it, or elongated from before backwards, or irregular, according to the part and extent of the circumference involved. Later, when the adenomatous tissue spreads upwards and projects into the bladder, the alteration is much greater. A thick rim that is not by any means soft or yielding may be built up around it, or around the posterior half; a rounded mass may spring up from behind and hang over it; or there may be two, one on each side, with or without a fold of mucous membrane to unite them; or three, one on each side, and one in the middle line behind as well. Much more rarely there is a single one in front. Sometimes, as in Fig. 3, the growth spreads backwards upon the upper surface of the trigone; sometimes it grows out irregularly in all directions, forming lobulated masses of the most varied shape and size.

Every growth of this kind increases the amount of work thrown upon the bladder. They all raise the orifice, and so form a pouch behind, and they all increase the resistance in the prostatic urethra; but some are much worse than this. They may grow round and over the orifice, making it smaller and smaller until at length they close it altogether, in spite of the most strenuous efforts on the part of the muscular coat.

If, for example, there is a single lobe projecting upwards either from behind or one side, or if there are three arranged symmetrically around the orifice, micturition may be impossible unaided. As soon as the bladder begins to contract and the urine is pressed from all sides on to the exit, the lobe or lobes are shut down like a valve, and the more the muscles contract the more tightly the orifice is closed.

If the median growth, instead of projecting upwards into the bladder, juts forwards from behind into the urethra, below the orifice, the result is almost as bad. Only in this case the flow of urine is not stopped at the beginning, for at that time the muscles around the lower part of the bladder are relaxed, but later, when the bladder has partially emptied itself and these are beginning to take their turn. The immediate result is a dilatation of the post-prostatic part of the cavity, and this follows all the sooner because the apex of the trigone is in these cases always raised as well as prolonged forwards.

There is another and entirely different way in which prostatic

outgrowths that project into the bladder increase the work it has to do. Like many true vesical tumours growing near the neck they often cause the most intense irritation. Whether this is dependent wholly or in part upon the congestion of the mucous membrane that accompanies them is not material. In many of these cases the contraction is almost incessant. As soon as a few drops of urine collect they are expelled with violent spasm and without relief, the muscular contraction beginning again almost at once.

When congestion sets in the difficulty in micturition and the amount of work thrown upon the muscular coat become much greater. The channel is narrowed still more by the swelling of the mucous membrane that surrounds it—outgrowths that did not touch each other now meet across the opening and are wedged together—and the soft and vascular tissue lining the neck, that gave way when the pressure increased before, is hard and rigid now. At the same time the sensitiveness of the mucous membrane is immensely increased, the frequency of contraction becomes greater and greater, and the intervals during which the bladder is allowed to be at rest are short and far between. In the vast majority of cases it is the onset of congestion that forces the patient to pay attention to his symptoms and makes him seek advice.

2. *The impairment of nutrition.*

Enlargement of the prostate not only throws a serious mechanical obstacle in the way of the bladder, rendering complete evacuation of the urine difficult, but by the chronic congestion and œdema that it causes it undermines the nutrition of its walls, weakens its muscular power, and renders it more susceptible to attacks of inflammation.

The arrangement of the prostatic plexus has already been described. In childhood and in youth it is only of moderate dimensions, and all the vesical and other veins that enter it are accurately valved (Fenwick). In old age it enlarges to an enormous extent; the valves disappear, and lying as it does almost at the lowest point of the venous system of the pelvis, surrounded by organs the blood supply of which presents the greatest variations, it is exceedingly liable to attacks of congestion and thrombosis.

Enlargement of the prostate, when it gives rise to any symptoms at all, always causes straining, and straining, frequently repeated, acting upon an intricate plexus of valveless veins, always causes congestion. Often the bowel is affected as much as the bladder.

Hæmorrhoids and prolapse of the rectum are seldom wanting in long standing prostatic enlargement.

So universal is congestion in connection with enlargement of the prostate and so grave are the consequences it entails that some have felt inclined to regard it as the cause not merely of the symptoms, but of the enlargement itself. This, plainly, it cannot be. No amount of congestion can lead to glandular overgrowth.

Congestion may set in very suddenly and become extreme almost at once, or it may be gradual and persistent, with every now and then a sudden increase. When it is acute it acts, so far as the immediate effect upon the bladder is concerned, in the same way as a valvular outgrowth, and as suddenly. From one minute to another the mucous membrane lining the neck of the bladder and the prostatic portion of the urethra swells up, the orifice is closed, and the bladder, whether it is hypertrophied or not, is unable to empty itself. This is the cause of most of the cases of sudden retention of urine occurring in old men with enlargement of the prostate, and the consequences depend very largely upon the speed with which relief is obtained. Hæmorrhage into the cavity and the walls of the bladder is so common as to be the rule. Atony afterwards is almost invariable. The loss of power may be complete, as sometimes happens in young men after a single act of over-distension, or it may be partial and temporary, the muscular coat recovering to some extent. Retention of urine, however, arising from acute congestion or thrombosis in a case of enlargement of the prostate, unless it is instantly relieved, always leaves behind it some degree of permanent impairment, some increase, however slight, in the amount of residual urine.

The chronic congestion that is kept up by the constant straining is equally serious, although its immediate consequences may not be so alarming.

It increases the liability to inflammation. The interior of the bladder, especially the most sensitive and the most exposed portion, that which lies around the neck, is kept in a state of constant slight catarrh. The epithelial cells are badly developed and unable to protect the structures beneath, and the mucous membrane is swollen and œdematous, and filled with varicose and thrombosed veins. Now, so long as the bladder is healthy, its surface is impervious to organisms. As Guyon ("Internat. Clinics," Series II., Vol. iv.) has shown, pus containing myriads of the bacterium

pyogenes may flow through the bladder for weeks together without being able to affect it in any way. Even if the surface is injured, scratched, for example, or rubbed, the liability is but little increased. But let congestion, or what is worse still, congestion and retention set in, the power of resisting infection is lost, and inflammation follows and rapidly becomes septic.

It increases the work that has to be done. When the mucous membrane becomes congested the exit from the bladder is narrowed, the resistance to the flow of urine is greater, and, above all, the sensitiveness of the mucous lining at the neck of the bladder is increased, so that contraction becomes more and more frequent.

And it weakens the power of the bladder. Just at first, while the work to be done is still within its range, the muscular coat may become hypertrophied and columns and ridges may begin to stand out under the mucous surface. But inevitably as the congestion increases and the blood supply grows worse, the nutrition of the fibres fails ; many of them undergo degeneration and disappear, and a condition approaching solid œdema sets in. The walls grow hard and rigid, the exudation that fills the interstices becomes organized, flexibility is lost, the bladder can neither contract nor expand as it should, and even though the walls grow thicker, the power of expulsion diminishes.

Enlargement of the prostate, therefore, whatever form it assumes, and without taking into consideration any of the complications that are nearly always present, invariably increases the amount of work by adding to the resistance in front, or by causing increased frequency of micturition, or by both together ; and, at the same time, owing to the straining and congestion that it always brings with it, it impairs the nutrition of the bladder, weakens its power of expulsion, and renders it much more susceptible to inflammation. The result depends partly upon the rate and the amount of increase ; partly upon the extent to which the nutrition is affected.

(*a.*) In many instances the difficulty is so slight or is overcome so easily that there is never any straining or congestion ; the patient's attention is never attracted to it, and the condition of the bladder does not suffer. A sufficient degree of hypertrophy takes place, the walls become a little thicker and more rigid, the bladder loses a certain amount of its distensibility, that is to say, it cannot hold without inconvenience quite as much urine as it used to do in younger life, but the obstruction never becomes serious, complications never set in, and the patient is never troubled by it.

(*b.*) In another class the result is not so good. The balance between work and strength is lost. In some of these the obstruction becomes too great. The physical conditions at the neck of the bladder grow worse and worse; the orifice is raised high above the level of the base, or the posterior wall of the urethra grows forward and blocks the channel. In others the power of the bladder fails. The muscular coat never becomes hypertrophied, or if its strength does increase at first it is only for a time. In many cases both these conditions are present. The bladder is unable to expel the whole of its contents. A certain amount of urine always remains behind, occupying the hollow immediately at the back of the trigone, the part that is emptied the last. At first the quantity is not considerable, but gradually the muscular coat gives way more and more (this part of the bladder has the weakest walls, and owing to its being emptied last has most work to do), and at length a thin-walled post-prostatic pouch is pushed out. When once a beginning has been made further progress is a matter of less difficulty. The conditions that occasioned the dilatation at the commencement have much greater influence over it when it is once established, and the only limit to the size it may reach is the pressure of the other organs around. It has been known to extend down between the prostate and the rectum until it rested upon the perineum.

(*c.*) In other cases the enlargement ends by causing complete retention. The upgrowth acts as a valve, falling over the orifice as soon as the urine presses down upon it, and the more vigorous the effort the more tightly is the valve wedged in. Atony, followed, sooner or later, by cystitis and decomposition of urine, is the invariable result. It may be immediate, the muscular coat of the bladder being stretched to such an extent that it loses the power of contraction, or it may be slow and gradual. But as a catheter must always be used in cases of this kind to empty the bladder (unless an artificial opening is made) atony is certain. Habitual catheterism ruins the bladder. The muscular coat, relieved of all work, undergoes degeneration, and the bladder is reduced to the condition of a passive receptacle, in which sooner or later cystitis always breaks out. How long it may be before the loss of power is complete varies very much. Two years, according to Sir H. Thompson, is enough in any case; but happily it has been shown by McGill, Buckston Browne, and others that recovery is possible after a much longer interval than this. The fact, however, remains,

retention caused by a valvular outgrowth always leads to atony, and this as invariably to cystitis and septic urine.

(*d.*) In a fourth class again the early occurrence of irritability is the prominent feature. The work is increased whether the resistance in front is affected or not. The bladder contracts more and more frequently; the walls grow thicker and stronger; the muscular bundles increase in size and strength, standing out in great columns under the mucous membrane; sometimes a sphincter is developed around the neck, and the cavity diminishes in size. For a time the bladder keeps equal to its work. Then, sooner or later, owing to the persistent straining, chronic congestion and impairment of nutrition follow. Solid œdema sets in. The muscular fibres waste and are replaced by lowly organized fibrous tissue. Some parts of the walls yield and give way. Others retain their thickness and grow hard and rigid, and at last the bladder degenerates into an irregular sac, no longer capable of emptying itself, but always retaining a certain amount of urine stagnant in its recesses.

As these different conditions not unfrequently occur together or follow each other, obstruction, for example, increasing until it becomes complete or irritability suddenly supervening when the bladder can scarcely overcome the resistance, it is easily understood how enlargement of the prostate, acting by itself, without any help from inflammation of the bladder, effects the most profound alterations. It may lead to distension or contraction. It may make the walls grow thick or thin, or thick in one part and thin in another. It may alter the shape completely, causing great pouches to protrude. It may leave the mucous membrane smooth and unaltered in colour, or irregularly thickened and covered with depressions. It may cause hypertrophy of the muscular coat, or fatty degeneration, or first one and then the other, and with the aid of old age and chronic congestion it may lead to such a condition of fibroid induration that the walls become hard and rigid, much thicker than natural, and lose their flexibility completely.

The effect of enlargement of the prostate upon the kidneys.

The influence of enlargement of the prostate is not confined to the bladder. The kidneys soon begin to feel it as well; the size diminishes; the pelvis and the calyces become dilated; the capsule grows adherent, so that it cannot be stripped off without bringing away little fragments with it; the delicate connective

tissue that lies between the tubules is replaced by a tough fibrous substance ; many of the secreting tubules disappear, and the general texture becomes dense and hard.

Changes of this kind are found in most cases of enlargement of the prostate in which there is residual urine, if not in all. Similar changes, more severe in character, are found in general atheroma. The important point is to determine in each case how far they are of constitutional and how far of local origin.

According to Guyon the cause is always and wholly constitutional. Renal degeneration is merely one part of a general disorder of which prostatic enlargement is another. The enlargement has no direct influence upon the kidneys.

I have shown this to be incorrect in the case of the bladder, and I think there can be no doubt that it is equally incorrect in the case of the kidneys. That renal degeneration is the rule in general atheroma, and that this is of common occurrence at the same time of life as prostatic enlargement there can be no question. But it does not follow that atheroma is always the cause of the renal changes, much less that it is the sole cause. They may be and often are produced in other ways. It is by no means uncommon to meet with serious renal inefficiency in patients suffering from enlargement of the prostate, where heart and arteries, so far as they are accessible, afford no evidence of the existence of atheroma.

Mechanical pressure alone, such as is caused by undue frequency of micturition in the face of increased resistance, is capable of producing a certain amount of effect; but its influence is slight in comparison with that exerted by the persistent congestion kept up by the reflex irritation starting from the neck of the bladder. The vaso-motor nerves of the kidney are affected by everything that irritates the opposite organ, or the mucous membrane of the deep part of the urethra and the neck of the bladder. Renal congestion is of common occurrence after the passage of a catheter. As a rule it is transient, and soon passes off, but hæmaturia and even suppression of urine have been known to follow. When the prostate is enlarged the sensitiveness of the mucous membrane is often immensely increased. The least stimulus is able to produce an effect that appears to be altogether disproportionate, and this, if constantly repeated many times a day for years together, gives rise to changes that at last become permanent. Those in whom the frequent passage of a catheter renders the mucous membrane

lining the urethra hard and insensitive may escape. In others the renal congestion becomes chronic, and at length is followed by contraction and degeneration.

Nor is it absolutely necessary, in order to produce this effect, that a catheter should be passed, or that any other unusual irritant should be applied to the urethra. I have met with instances in which, judging from the clinical symptoms, there was a serious degree of renal inadequacy, though there was no evidence of atheroma, and no steps had as yet been taken for the removal of the residual urine. The irritation kept up by the spasm of the muscles around the neck of the bladder, and the intensely sensitive condition of the mucous membrane had been sufficient. But I have not met this without residual urine, and without its having been present, so far as one could judge, for some considerable time.

Renal degeneration, no doubt, is more extensive, and advances more rapidly when due to general atheroma; but I am convinced that although its influence may not be so powerful, enlargement of the prostate, partly by the mechanical obstruction that it causes, partly by the persistent congestion that accompanies it, is capable, by itself, of inducing in the kidneys changes of a similar description.

Enlargement of the prostate, however, never does occur by itself. There are always other agencies working with it, complicating it, and assisting it in causing degeneration of other organs.

Old age is one. Enlargement of the prostate, as I have already shown, begins at a much earlier period of life than is usually believed; but, though there are exceptions, it rarely leads to serious results until late in adult life. Now by this time the tissues of the bladder have in most cases lost much of that faculty for adapting themselves to altered conditions, which is such a characteristic of youth. The walls are stiffer and more rigid; the mucous membrane denser and less flexible; and the muscular fibres, instead of responding to the call of increased work by hypertrophy, tend rather to waste and give way. Increased resistance leads to dilatation, and not increased strength; and even when strength is increased at the first, it is only for a while; the result is the same, only it comes more slowly.

Inflammation is another. As already mentioned, enlargement of the prostate is not in any sense of the term inflammatory.

There is no connection between it and inflammation; but sooner or later inflammation always does set in, beginning in the mucous membrane of the bladder, and extending thence into the deeper layers and into the substance of the prostate.

There is everything to encourage it. The tissues are badly nourished and unable to resist injurious influences, owing to the state of chronic congestion in which they are living. The epithelial lining can no longer act as a protection against infective organisms. Urine mixed with mucus collects and lies stagnant in one part of the bladder. Foreign bodies, in the shape of catheters, are continually being introduced, and though the greatest care may be taken at first, the necessary precautions are certain to be relaxed as time goes on.

The effect, even when the inflammation is of the most trivial character, is to make all the consequences of the prostatic enlargement much more serious. The mucous membrane becomes more swollen and irritable. The contraction of the bladder is more frequent. The congestion and œdema of its walls grow worse. The nutrition suffers more. The tendency to hæmorrhage is greater. The work is increased in every way, and the strength to do it reduced more and more.

This happens even when the attack is superficial. When it becomes septic, and inflammation of the bladder in a case of enlargement of the prostate never does continue long without becoming septic, the consequences are infinitely more severe.

The organism that causes septic cystitis is probably always the bacterium pyogenes of Clado and Albarran. Achard and Renault ("Compt. Rend. de la Société de Biologie," 1891, p. 830) have shown that this is the same as the bacterium coli commune, which varies to such an extent in the intensity of its action. So long as the mucous lining of the bladder is healthy it is harmless. If, however, the walls become congested, and still more if they become inflamed, the bacterium, which, unless the greatest precautions are taken, is certain sooner or later to gain access by means of the catheter (and may without), breaks through the ill-developed epithelial layer, spreads into the mucous and submucous tissue, and sets up the most intense inflammation.

The effect that septic inflammation has upon the bladder, even under ordinary conditions, is of the most serious character. If the attack is acute a fatal result may ensue in the course of a few days

from uræmia and septic absorption. Even when not sufficiently severe for this, the bladder, and, later, the kidneys, sustain an amount of injury that in many cases can never be repaired. The remaining epithelium is detached in flakes and masses. The mucous membrane becomes more and more congested and swollen. In some places the surface is coated with a slimy mixture of phosphates and mucus; in others it is reddened or blackened by hæmorrhages of different ages; in others, again, it is raw and ulcerated, so that it bleeds at the slightest touch. Underneath, the submucous tissue is engorged with lymph and filled with thrombosed veins. Many of the muscular fibres disappear, and are replaced by dense fibroid tissue; and this, in course of time, if the inflammation continues, collects into great ridges, separated from each other by depressions that are often the mouths of sacculi. Everywhere the pathogenic organisms multiply more and more quickly as the resistance of the living tissues diminishes; the walls become swollen and filled with lymph, and the normal structures are either destroyed altogether and replaced by masses of exudation or so far disorganized as to be incapable of working.

Nor is this confined to the bladder. If the inflammation continues it soon extends upwards into the ureters and involves the pelvis and the kidneys. The mucous lining is the first attacked. Then the organisms penetrate into the deeper layers, carrying suppuration wherever they go, until at length the secreting structure of the kidney, cortex as well as medulla, is riddled with abscesses.

These are the results that ensue when septic cystitis occurs without any obstruction to the exit of the poisonous urine. When the prostate is enlarged, so that the bladder is unable to empty itself, the consequences are, if possible, worse still. The residual urine undergoes ammoniacal decomposition, and becomes converted into an irritant poison of the most virulent type. Every drop as it falls from the ureters passes through a similar change, and adds to the amount. The bladder is entirely unable to help itself. Unless some artificial exit is provided, its walls, already weakened and inflamed, are constantly bathed with a poison which increases in amount and in intensity the longer it is left; and in a very little while, if the patient survives, they are reduced to a condition from which thorough recovery is almost impossible.

Enlargement of the prostate, in short, aided and abetted by attacks of congestion and cystitis, and occurring at a time of life

when degenerative changes are so usual as almost to be considered normal, is sufficient in itself, by the mechanical obstruction that it causes, and the way in which it interferes with nutrition, to explain all the changes that are ordinarily met with in the bladder and kidneys, no matter how great these may be. There is no need to invoke for their production the aid of any constitutional cause, such as general atheroma. No doubt when general atheroma does occur, as when there is any other general cause for malnutrition and premature decay, the effects follow more quickly and are more marked. But it is not necessary. The local causes are sufficient in the conditions under which they are at work. Enlargement of the prostate and atheroma may occur together and lead to much more serious consequences than either could alone; but they can also occur independently of each other, and the fact that they are often associated together at the same period of life and that the consequences that follow them are in some measure (so far as the urinary organs are concerned) alike, is no evidence that the one is the cause of or in any way related to the other.

CHAPTER V.

THE SYMPTOMS OF PROSTATIC ENLARGEMENT.

Decrease in the Force of the Stream—Difficulty in Starting—Dribbling at the End—Intermittent Micturition—Residual Urine—Overflow—Involuntary Escape of Urine—Incontinence—Retention—Increased Frequency of Micturition—Impairment of Sexual Power—Pain—Rectal Symptoms—Alteration in the Character of the Urine—Influence on Health.

In many patients enlargement of the prostate never causes any symptoms. They live their lives through, even to advanced old age, without suffering a moment's inconvenience from it or being aware of its existence. The increase is so slow that it does not stretch the fibrous capsule and cause pain like malignant disease or inflammation. There is no obstruction, or only so much as the bladder can overcome without difficulty, and there is no vesical irritability or impairment of general health.

In others, the minority, it is true, but a large one, certain symptoms very soon make their appearance. Some of them are due to the mechanical impediment at the neck of the bladder, caused by the alteration in the shape and size of the gland and the swelling of the mucous membrane. Others arise from the intense hyperæsthesia of the congested or inflamed mucous lining, and others again are secondary to the consequences induced by these.

Decrease in the force with which the urine is ejected is one of the earliest. The stream flows away from the meatus, dropping vertically down, and no amount of straining is of the least use. Sometimes indeed it makes matters worse, the stream becomes feebler and smaller or stops altogether for a while, and then begins again when the fatigue has passed off and the muscle has had time to recover. The resistance at the neck of the bladder is increased beyond the power of the muscular coat, the force is no longer equal to the work.

Difficulty in starting the stream is another. According to Professor White, mechanical obstruction is not the cause. The prostatic urethra is hyperæsthetic, the external sphincter is kept in

a state of spasmodic contraction by the reflexes that start from the mucous membrane lining it, and the muscles around the neck of the bladder are not under control. It is not quite the same, however, as the difficulty in what is called "stammering bladder," and though hyperæsthesia and spasm under other circumstances are not uncommon, this symptom rarely occurs unless there is enlargement. With greater probability it may be assigned to the alteration in the mutual relations of the structures that form the neck of the bladder. Normally as micturition begins the orifice dilates, and the neck becomes funnel-shaped. The contraction of the bladder begins with the longitudinal fibres and those circular ones that surround its main body; at the neck everything is relaxed. When there is a prostatic up-growth in the urethra this cannot take place; the walls are dense and rigid; the longitudinal fibres cannot shorten the neck or smooth down the projection caused by the apex of the trigone, and the first portion of the urethra cannot relax and form a single cavity with the bladder. Instead of its being filled with urine ready to pass out, the urine has to be forced down it by muscles that are placed at a disadvantage and soon become tired. All this takes time, and stronger impulses must be sent down the nerves before the bladder can gather up sufficient force.

Dribbling at the end of micturition is a third sign. It usually means that the bladder is beginning to fail. The clean expulsion of the last few drops of urine is mainly a voluntary act. It commences with the involuntary muscle that surrounds the lower part of the bladder, passes on from there to the first portion of the urethra, and is finished by the voluntary muscles that surround the apex of the prostate and the canal beyond. In many diseases of the central nervous system it is imperfectly carried out; and so it may be after exposure to cold. In this case the fault is with the voluntary muscles which do not act aright. In enlargement of the prostate it arises from a different cause. The urine towards the end of micturition is not sent down into the prostatic urethra with sufficient regularity or in sufficient quantity. The voluntary muscles cannot expel it as they should; their power is not impaired, but they do not receive the urine into their grasp at the proper moment.

Intermittent micturition, or sudden stoppage of a full stream without previous slackening (which must be clearly distinguished

from simple increased frequency), is not of common occurrence. It can only take place when the prostate has grown so that it can close the passage like a valve. The growth may be confined to the urethra, or it may jut out into the bladder from the median or lateral lobes, or from all three together, but it must be in such a position that it can close the orifice when the muscles contract, and leave it free again when they relax. Professor White considers this symptom more frequently due to spasmodic contraction of the external vesical sphincter and the compressor urethræ muscles, reflexly excited by urethro-cystitis. Intermittent micturition, however, is rarely met with in these circumstances in the absence of enlargement.

Residual Urine.—In the majority of cases of enlargement of the prostate, the bladder after a time fails to empty itself : a certain amount of what is called residual urine is habitually left behind. There may be only a few drops, or there may be many ounces, thirty and even forty. The quantity in each case varies a good deal from day to day, being greatly influenced by nervousness, the state of health of the patient at the time, and other causes, but throughout there is a continuous, if fitful, tendency to increase. The patient, unless it has actually been shown him already, is hardly ever aware of it. If the quantity is small there is no means for his knowing it. If it is large it diminishes the carrying capacity of the bladder by so much, and leads to frequent micturition, not unnaturally conveying to his mind the conviction that he is passing urine too frequently, or in too great quantity ; never that he is constantly retaining some.

The diagnosis is easily made by passing a catheter after the patient has, as he imagines, emptied his bladder ; and no examination of any case of enlargement of the prostate is complete without this. The precautions that must be taken will be detailed later, but it may be mentioned here that the proceeding, especially if the amount is large, is by no means devoid of risk. To form a correct estimate of the quantity, this must be repeated three or four times under different conditions. The amount is liable to vary, and careful note should be taken of any difference that is found. If it is at all considerable it is an indication not only that part of the bladder has lost its power of contracting, but that a further portion is almost in the same plight.

The urine, of course, collects in the lowest part of the bladder.

This is no longer the region of the orifice, for this has been raised by the elongation of the urethra, but the thin-walled post-prostatic portion. Here it rests almost undisturbed in all the ordinary positions of the body, standing, sitting, or lying down. As the quantity increases this part of the bladder is pushed out into a pouch, which may stretch down between the rectum and the prostate until it reaches the perineum.

Residual urine is not peculiar to enlargement of the prostate. It is met with in stricture and other conditions as well. Wherever it occurs the immediate cause is failure in the muscular power: the work is too great. It may be simply due to fatigue; the muscles begin well, but become tired out before their task is finished. This is especially likely to occur in old people, and when the nutrition of the coats of the bladder has been impaired by long continued congestion. Or it may be due to the prostatic growth in the urethra acting as a valve. When the muscular fibres that surround the lower part of the bladder begin to contract, the orifice is closed before the cavity is emptied, and some of the contents are left behind. Or it may be due to both of these causes.

Whatever the origin, whether it is fatigue or premature closure of the opening, the muscular fibres that act upon the lower part of the bladder, having the most work to do, are the first to give way. They lose their power of contraction, and to a great extent their tone. If a catheter is passed, the residual urine flows quietly away, owing to the pressure of the surrounding viscera: it is not expelled.

Towards the end of micturition pressure is brought to bear from all sides upon the fluid that is left. If the orifice is open the resistance is least at that spot; the urine flows out and the pressure is relieved. If it is rigid, or, still more, if it is closed by a valvular outgrowth, the weakest part of the bladder wall ceases to contract the first, and then begins to yield and stretch under the pressure thrown upon it by the rest. For this reason, when once there is a commencement of residual urine, more or less rapid increase is invariable. In old standing cases the size of the post-prostatic pouch is only limited by the pressure of the organs around it.

The fact that the urine is retained in the bladder does not in any way affect its character so long as the mucous membrane remains healthy and no irritant reaches it. It mixes with that which comes down from the ureters and is gradually changed. But as the

bladder always exerts a certain amount of tonic contraction upon the fluid inside it and (unless the residual urine is suddenly drawn off) is never too large for its contents, these remain almost stationary. As a consequence, when the mucous membrane becomes congested or cystitis sets in, and the amount of mucus increases, this, being heavier, slowly settles down through the layer of urine at the bottom of the pouch and remains stagnant there, adding greatly to the risk of decomposition.

Overflow.—As the amount of residual urine constantly tends to increase, a time at length is reached at which the potential capacity of the bladder is greatly diminished. Micturition in consequence becomes more frequent and at last almost continuous. The bladder is as full as it can be ; its walls are so tensely stretched that it can hold no more, and as the urine enters it by the ureters some must leave it by the urethra. This is known as overflow, and must be clearly distinguished from incontinence.

Involuntary escape of urine at night is the first sign of this. Overflow cannot take place so long as the external sphincter is in active work. It begins, therefore, at night during sleep. Later it takes place during the day as well, especially when the abdominal pressure is raised by muscular exertion ; the sphincter or the nerve centre that controls it is either tired out or taken unawares.

Incontinence.—This is one of the rarest of the symptoms of enlargement of the prostate. Formerly it was often confused with overflow, but as Sir H. Thompson has shown, the two conditions are entirely distinct. In true incontinence the bladder is empty and remains so ; in what is commonly called incontinence, but which is really overflow, the bladder is over full and continues over full throughout.

Enlargement of the prostate can only cause incontinence of urine when the growth at the neck of the bladder is of such a shape that the urine flows continuously into the prostatic urethra ; and when, in addition to this, the sphincter at the apex of the gland is unable to act. Either of these conditions alone is insufficient ; they must be present together.

The first is not uncommon. It is by no means rare to find on passing a catheter that the prostatic urethra is dilated into a chamber lying in front of the bladder. Sometimes it is so large that a short beaked sound can rotate in it without difficulty. The orifice by which it communicates with the bladder may be the

widest portion of the cavity, so that it is funnel-shaped with the apex downwards, or it may be quite small. The essential point is that the communication is kept open. The urine is only prevented from flowing away by the contraction of the voluntary sphincter in front, and the resistance of the urethra. The enlargement in cases of this kind is, generally speaking, uniform. All parts of the gland are involved pretty nearly equally. Mercier, in his four cases, described the median lobe growing forward, like a wedge, separating the lateral ones, and opening up the neck of the bladder. As Sir H. Thompson points out, the wedge in these cases is usually directed upwards towards the bladder, and not forwards. Nor is this action necessary so long as the median portion of the gland is sufficiently wide; and such a condition is not very rare.

Loss of power over the external sphincter, the other factor necessary to the production of true incontinence, is only met with in affections of the central nervous system, or of the nerves themselves. I have met with it, for example, in cases of locomotor ataxy and in cerebral softening; and in one of these it was associated with this particular form of prostatic enlargement, and with true incontinence. The bladder which, when I first saw the patient only a few weeks before, had been of very large capacity, could only retain a few ounces. As soon as more than this collected it began to flow away. The only forces left in action were the tonic contraction of the muscular coat, which was not very strong, and the resistance of the urethra. As soon as the one exceeded the other incontinence resulted; and had the tone of the bladder been good it would have remained persistently empty.

Retention of urine.—Complete retention may occur without warning or anything that could raise a suspicion of enlargement. Much more frequently there has been trouble for a long time before, such as delay at the beginning, want of force in the stream, or some other of the symptoms already mentioned. The immediate cause is either sudden failure in power or sudden increase in the resistance, or both together.

The former is seldom altogether wanting, although it is rarely entirely sufficient by itself. Occasionally, however, retention follows voluntary postponement of the act of micturition. Urine is allowed to collect in the bladder until the usual quantity is exceeded. The muscular coat has been weakened by congestion or inflammation, but is still able to deal with a moderate

amount. Suddenly it is called upon for a much greater effort, and it fails.

Sudden increase in the resistance is more common. It arises nearly always from congestion and swelling at the neck of the bladder. There may be a valvular outgrowth hanging over the orifice, or three meeting over it when micturition begins; or there may be merely enlargement of the lateral lobes compressing the urethra from side to side. For some time past the bladder has been acting at a disadvantage, but has been able to get rid of its contents. Suddenly the mucous membrane becomes congested and swollen; the size of the valve is increased, or the half-closed passage completely shut, and nothing more can pass.

Patients with enlargement of the prostate are peculiarly susceptible to these attacks of congestion, especially when the kidneys have become affected. Or perhaps the true explanation is that congestion at the neck of the bladder is more common in old men than is usually imagined, but it does not cause retention or any other trouble unless it is superadded to already existing enlargement. Whichever of the two is correct, in retention of urine due to enlargement of the prostate congestion is almost invariable.

The congestion may be inflammatory, arising from cold or from an irritating condition of the urine, or it may be passive, the result of obstruction to the return circulation. Excess in food or drink, especially in alcohol; exposure to cold or wet; attacks of constipation; sexual indulgence; riding; long railway journeys; anything in short that increases the amount of blood flowing through the pelvic organs may act as the exciting cause; and when it has once set in the straining that attends the act of micturition makes it tenfold worse. Often the veins in the mucous membrane become so distended that they give way, and the blood pours out either into the thickness of the wall or into the interior of the bladder, where it mixes with the urine.

The relative share taken by glandular overgrowth and by congestion in causing prostatic retention can only be estimated in any individual case by the events that follow. Simple congestion, if the urine is drawn off at regular intervals, and the patient is kept quietly in bed, without stimulants and secure from all sources of irritation, soon begins to subside. Even when thrombosis has occurred, a certain degree of improvement usually shows itself in the course of two or three days, although it is often many weeks

before control becomes as good as it was. Enlargement, on the other hand, remains unaffected, or slowly increases.

Retention must be distinguished from the accumulation of residual urine. In the former the exit is closed, and immediate relief is imperative. In the latter the surplus flows away without hindrance, and although it is not a condition that should be allowed to continue longer than can be helped, there is not the same demand for urgency. If retention is not relieved at once the pain becomes more and more severe ; the bladder and then the ureters and the pelves of the kidneys are distended to their utmost ; the secretion of urine is checked by the rising pressure, and symptoms of urinary poisoning rapidly follow.

Even when the urine is drawn off with the least possible delay, a certain amount of injury is always inflicted upon the urinary apparatus. The muscular coat of the bladder is strained and loses power, especially if the walls are thin and the cavity large. For weeks after an attack of retention the residual urine is more abundant than it was before ; and even complete atony may occur. Nor do the kidneys escape ; fever always follows acute retention, and it not unfrequently happens that it is some considerable time before the secretion of urine becomes normal again.

Increased frequency of micturition begins very early, long before there is any considerable amount of residual urine, and is due to the increased irritability of the mucous membrane lining the neck of the bladder and the first part of the urethra.

The stimuli that excite micturition always start from this, the rest of the bladder being comparatively insensitive. Morbid growths, for example, situated in this part, or calculi impacted there, act as intense irritants, while in other parts of the bladder they have but little effect ; and bulbous sounds while passing through the orifice often excite a keen desire to urinate, which ceases as soon as the bladder is reached. In enlargement of the prostate, this part is very liable to become congested; the mucous membrane lining it grows exceedingly sensitive, and causes that would ordinarily have very little influence act with the greatest vigour.

Increased frequency of micturition during the early stages of the disease usually means that there is some active irritant present, such as a growth springing up in the neck of the bladder or some morbid condition of the urine. Later, when the mucous mem-

brane is inflamed, the slightest stimulus is sufficient, the mere contact of the urine with the tender surface or the pressure caused by spasmodic contraction of the muscles. When this stage is reached the frequency becomes greater and greater, until at last micturition is almost incessant, and causes the most acute suffering. The muscle around the neck of the bladder is in a state of constant spasm. The mucous lining, which is so tender that it cannot bear the slightest touch, is crushed by its contraction, and the burning pain at the neck of the bladder never ceases. The only time when there is the least relief is the moment that the urine is actually passing.

The worst cases are those in which a minute ulcer or fissure is formed between the congested folds at the neck, exposing some of the terminal nerve filaments. Every few minutes some drops of urine are ejected spasmodically, and the moment micturition is over the intense irresistible desire begins again, worse, if possible, than it was before, until the patient's strength and endurance are worn out.

In many cases of enlargement of the prostate the quantity of urine that is secreted within twenty-four hours is considerably increased, and this naturally has a direct, though not very important, influence upon the frequency of micturition. The changes in the kidney that lead to it may be simply the result of advancing age, or of commencing atheroma, or of chronic congestion set up by reflex irritation from the neck of the bladder. The specific gravity is lowered at the same time, and this, again, when the mucous membrane is so exceedingly sensitive, helps in the same direction, especially as the urine secreted under these conditions not unfrequently contains small quantities of oxalates.

It is usually said that the frequency is greater during the night-time than during the day. This does occur sometimes, but I am inclined to doubt whether it is so common as is usually believed. Careful inquiry into cases that give this history often shows that the patient passes water much more frequently than he imagines. There is nothing during the daytime to impress the act of micturition upon his mind, so long, that is to say, as there is no difficulty. The conveniences are so great that they are taken advantage of almost unconsciously—at any rate, without sufficient mental effort to ensure the number of times being remembered unless every single thing done during the day is passed under review. Micturi-

tion has become an acquired automatic act. At night it is different, and until habit has become second nature, or the number of times is considerable, each one is recollected and counted.

The time when the increased frequency occurs is generally the early morning. The patient sleeps fairly well for the first few hours after going to bed, a longer interval without micturition than is usual with him during the daytime. At last the call becomes so urgent that it wakes him. By that time the bladder is uncomfortably distended ; the muscular coat is stretched beyond its custom ; the work it is called upon to perform is greater than usual, and it becomes tired before its task is finished, so that the patient has to rise two or three times again before morning. The first interval was too long.

In a few cases, however, the frequency of micturition during the night is certainly greater, and the cause, I believe, is to be found in the character of the urine. There is nothing in the recumbent position to occasion it, nor, as a matter of fact, is it noted when the patient is lying down in the daytime. It cannot be assigned to congestion of the sexual organs (such as not unfrequently comes on during the night-time in cases of prostatic enlargement), except in the most distant way, by increasing the amount of blood flowing through the pelvis. Penile erections, as a rule, exert an inhibitory influence upon micturition. On the other hand, there is no doubt that late dinners, and particularly the common habit of taking spirits the last thing at night, augment the quantity of the urine secreted during the next few hours, and frequently render it more irritating in quality. Under normal conditions the cause may be too slight to produce any effect, but when the neck of the bladder is congested and unduly irritable exceedingly little is required. Whether this is the general reason or not I am not prepared to say ; certainly it was the cause in some of the cases that have come under my notice, for by careful attention to particulars of this kind, and by relieving the congestion as far as possible, I have not unfrequently succeeded in prolonging the intervals of rest very considerably.

It is probable that the greater frequency at night would never have attracted so much attention had it not been for the striking contrast presented in this respect by patients who are suffering from stone in the bladder. Under these circumstances the frequency of micturition is very much greater during the day. At night and

when the patient is lying down, so that the calculus does not move or come into contact with the neck of the bladder, it subsides almost entirely.

In the later stages of the disease, when the muscular fibre of the bladder has lost, or almost lost the power of contraction, frequency of micturition may also be caused by the accumulation of residual urine; but this cannot occur until the amount is considerable. "If a bladder, which holds ten ounces comfortably, fails to evacuate the last ounce of water, the only effect of this is to reduce the comfortable capacity of the viscus to nine ounces, thus necessitating an increase in the number of urinations not sufficient to be appreciated and not commensurate with the frequency noted in many cases where the residual urine is small in quantity. That residual urine alone, without the supervention of congestion or inflammation of the vesical mucous membrane, is not sufficient to cause frequent urination, is shown by the fact that a healthy man may voluntarily retain in his bladder portions of the urine at each micturition and yet will suffer no appreciable increase in the diurnal number of micturitions." (White).

Impairment of sexual power.—Whether enlargement of the prostate has any direct influence upon the sexual power is uncertain. As already mentioned, the prostatic fluid appears to be essential to the continued activity of the spermatozoa; and certainly in most cases of enlargement the structure of the whole gland is so affected that it is scarcely probable that its function can be carried out efficiently. It is conceivable that certain forms of enlargement might interfere with the due carrying out of the sexual act itself; but the question is not yet ripe for settlement.

The other symptoms that are met with in cases of prostatic enlargement arise almost entirely from the congestion and cystitis that accompany it.

Pain is never caused by mere enlargement; the rate of increase is too slow. It is always due to congestion or inflammation increasing the sensitiveness of the mucous membrane at the neck of the bladder or stretching the fibrous tissue that surrounds the gland, and is proportionate to the acuteness of the attack. There may be merely a little aching in the perineum, with some increase in the frequency of micturition, or there may be intense pain shooting down the thighs into the testes, or round the back, down, in short, every branch of the sacral plexus, with burning at the neck of the

bladder and at the end of the penis so intolerable that the patient can hardly be held responsible for his actions.

Rectal symptoms.—A sense of fulness in the rectum, as if there was something there that could not pass, is a common cause of complaint. The patient is always desiring to go to stool and perpetually straining without result. In a few cases this arises from direct pressure, the gland attaining an enormous size or growing backwards to an unusual degree. Instances have been known in which it has proved an actual source of difficulty in this way. But a far more frequent reason is the congestion of the mucous lining, arising from the constant straining. In the later stages hæmorrhoids and sometimes prolapse make their appearance, and as the power of control diminishes involuntary escape of flatus and fæces during micturition becomes of common occurrence, and a source of great distress.

The character of the urine.—So long as the bladder remains healthy the most important change is an increase in the quantity and a diminution in the specific gravity. This is due to the fibroid induration and contraction of the kidneys which is so commonly present in long-standing cases of enlargement, and which is the product of many different causes acting together, age, arterial degeneration, the strain thrown upon the secreting structure by the backward pressure from the bladder, and the persistent hyperæmia of the kidneys kept up by reflex irritation from the over-sensitive neck of the bladder.

In the early stages of the disease albumen and casts are seldom present. But if, when the specific gravity of the urine is habitually low, there is the least disturbance, such for example as that induced by passing a catheter and drawing off the residual urine, they make their appearance at once.

In the bladder the urine is but little changed. More mucus is secreted, and there is a more rapid proliferation of the epithelial lining, causing a thin floating cloud to make its appearance, but nothing more. Other changes follow as soon as congestion begins. The amount of mucus increases; it no longer forms a faint cloud, but collects at the bottom as a distinct deposit, and blood is often present. Occasionally there is free bleeding, a varicose vein at the neck of the bladder giving way, or more commonly, some injury being inflicted by a catheter. For a day or two the colour is bright red, then it becomes brown and smoky, growing lighter and lighter

until it is normal again. In exceptional cases the hæmorrhage is so free that the bladder becomes distended with coagula, which, if not broken up and removed, slowly melt down into a dark slimy mass, coming away only with difficulty and after many days.

When cystitis breaks out and the germs that gain access to the bladder are able to penetrate through the altered epithelium into the deeper layers of the mucous membrane, the urine rapidly becomes ammoniacal, and the inflammation much more severe. The mucous membrane that lines the ureters and the pelves of the kidneys, and then the tubules themselves become involved. Albumen and casts make their appearance in abundance. The quantity diminishes; the reaction becomes alkaline; the odour most unpleasant, and all the phosphates and salts that are insoluble in an ammoniacal fluid are precipitated in the mucus that covers the inflamed and often ulcerated surface. In the bladder the decomposition advances farther still. The mucous membrane in a state of acute inflammation pours out a quantity of mucus which mixes with the phosphates, and acted upon by the alkalies forms a tenacious glairy mass that separates from the rest and clings to the side. The odour becomes peculiarly offensive. It seems as if the contents of the bladder, when the mucous membrane is inflamed, are capable, like the pus in abscesses near the bowel, of absorbing odours from it. And it acts as the most intense irritant, making the bladder contract every few minutes with the most painful spasm, crushing together the raw and ulcerated surface at the neck.

The state of health.—Enlargement of the prostate has no influence upon the general health, except through the secondary changes it induces in the kidneys and the bladder. In the early stages there is nothing to notice. As micturition becomes more frequent, and an undue strain is thrown upon the secreting structure of the kidney, vague evidence of failing strength begins to appear. The patient seems to have aged rather suddenly. His friends describe him as not the man he was. He is more liable to colds and slight feverish attacks, and he does not rally from them at once. There is not the same amount of energy in what he does; neuralgia is common; sleep is broken, and the appetite capricious. Loss of weight is very general; the skin feels dry and harsh, and wrinkles become much more evident, especially around the eyes. But with all this the patient may complain of nothing

very definite; the failure is general, and the strength and nutrition of all the tissues suffer.

Events move much more rapidly when acute congestion sets in and the neck of the bladder becomes irritable. The kidneys are congested, their secreting power is impaired, and the tissues cannot dispose of their nitrogenous waste. The loss of flesh and vigour rapidly increases, and the constant pain at the neck of the bladder and the ceaseless desire to urinate undermine the patient's strength completely. The bowels become disordered; the perpetual straining leads to hæmorrhoids, which often bleed profusely; the appetite is lost; the tongue becomes dry and red; sickness is not uncommon; and all the signs of incipient uræmia make their appearance.

When cystitis sets in, and the urine decomposes in the bladder, septic absorption is added to the rest. The pulse becomes small, quick, and feeble; the temperature rises to 102° or 103° F.; rigors sometimes occur; and the patient passes into a dreamy state, with low muttering delirium, until diarrhœa, with a subnormal temperature or coma, and perhaps at length convulsions, follow.

CHAPTER VI.

DIAGNOSIS.

The Condition of the Prostate—Rectal Examination—Urethral Examination—The Length of the Prostatic Urethra—Its Direction—The Shape of the Orifice—The State of the Bladder—The Amount of Residual Urine—The Tone of the Muscular Coat—The Condition of the Mucous Membrane—The Character of the Urine—The Condition of the Kidneys.

THE CONDITION OF THE PROSTATE.

The diagnosis of enlargement of the prostate seldom presents any difficulty. With complaints such as stricture and calculus it can only be confused through carelessness (it must not be forgotten that they often occur together). Malignant disease is very different in its course. It progresses rapidly, causes intense pain, and is accompanied by profuse, apparently spontaneous hæmaturia. In chronic inflammation the gland is tender, and shreds of mucus or casts of the prostatic follicles are present in the urine, and often exude from the urethra during defæcation. Tubercular disease, long before the gland has attained any dimensions, is attended by ulceration of the mucous membrane at the neck of the bladder and strangury; and owing to the caseation and breaking down of the parts most affected, the swelling is rarely uniform either in shape or consistence.

I have known a little difficulty arise from growths outside the prostate, between the bladder and rectum, and on one occasion from a calculus of unusual size impacted in the lower end of one of the ureters. But this was only so long as the examination was limited to the rectal aspect.

On the other hand, it is not easy to determine at the moment the share taken by the growth, vascular congestion, and chronic inflammation respectively in causing the increase in size. The symptoms that attract the patient's attention are nearly always due to the two latter; he seldom applies for relief on account of the growth alone.

Time soon tells. Congestion, if the cause is removed, begins to subside at once. Thrombosis, which, judging from the chains of phleboliths so frequently found in the prostatic plexus of old men, must be of common occurrence, takes a little longer. A certain amount of inflammation is always associated with it. The capsule and the loose cellular tissue that holds the veins together are swollen and filled with lymph ; and there is pain and tenderness when pressure is made with the finger in the rectum. But in a few days, if thorough rest is enjoined, the thrombi disappear or shrink up, and the exudation around the vessels becomes absorbed. The increase that is due to growth, on the other hand, remains permanent.

It follows that after an attack of acute retention (in which congestion nearly always takes a very important share) no definite opinion as to the size of the prostate or the condition of the muscular tone of the bladder should be given until the effects due to these accessory causes have had time to disappear. Still less should any operation, except one of urgency, be performed.

The alteration in the shape of the prostate is ascertained by rectal and urethral examination separately and in combination.

Rectal examination.—If the patient is lying on his side the posterior surface of the gland can be explored by introducing the finger into the rectum. The size, however, and especially the degree of projection upwards towards the bladder, can be ascertained a great deal better (if the abdomen is not too stout) by placing the patient on his back with the knees well drawn up, and while the forefinger of the right hand is in the rectum, making firm pressure over the pubes with the fingers of the other hand. The bladder should, of course, be emptied first. In thin patients it is quite possible to grasp, and even to manipulate, an enlarged prostate in this way.

In the young adult the prostate does not project backwards into the rectum, though it can be plainly felt through it. The finger can reach above it easily, and explore the trigone, and with more difficulty can pass a little way round on either side. The consistence is uniform and firm, and pressure does not cause pain or any additional discomfort. The upper border in most cases is slightly notched; definite convexity points to commencing enlargement. The lower end can be traced into the membranous part of the urethra.

When the median lobe of the prostate is enlarged, or when all three are enlarged together, it grows backwards against the anterior wall of the bowel. The finger meets it at once, and has to be directed towards the sacrum in order to pass it. The upper border becomes convex and massive, and the trigone recedes so far that the finger may be quite unable to reach it. When the lateral lobes only are involved the trigone is carried as high, but the backward projection is less, and the notch remains distinct. Any conspicuous inequality between the two sides can be detected easily.

In general enlargement the surface is rounded and uniform. Exceptionally it is nodular, with projections upon it slightly softer than the parts between. Examination always causes discomfort, but it should not cause pain. General tenderness points to recent congestion. When it is most marked upon the sides and the upper part of the gland, and the central portion near the apex is unaffected, there is in addition thrombosis with inflammation of the cellular tissue around the veins. In these cases the increase in size is rapid. The mucous membrane of the rectum is hotter than natural, and the sphincter is not unfrequently in a state of rigid spasm.

Examination by the rectum, however, gives but a very limited amount of information. It can tell nothing as to the position occupied by the urethra, or the degree of compression to which it is subjected, or the alterations in its course and in the orifice of the bladder. The prostate, as felt through the rectum, may be normal in size, or so slightly enlarged that it tends rather to throw discredit upon the diagnosis than to assist it, and yet there may be distinct and serious urinary troubles. As McGill pointed out, the prostatic enlargement that causes obstruction is intravesical (and urethral), not rectal. Very small growths in the region of the orifice may cause complete retention, while that part of the body of the gland that can be felt through the rectum is entirely unaffected.

Urethral examination.—Various instruments are required to make this complete. A full-sized prostatic catheter to ascertain the length; a short-beaked metal sound; various soft catheters, "coudé" or "bi-coudé," to estimate the degree of projection upon the floor; the cystoscope, and one or more prostatometers to measure the antero-posterior and transverse diameters of the canal. Whether cocaine or a general anæsthetic should be used depends upon the condition of the patient, and the amount of pain caused

by examination. The urethra in cases of this kind is as a rule more tolerant than it is in younger men suffering from stricture. The patient should be lying down, in bed if possible, and must be warmly clad. If not accustomed to the passage of instruments, or in any case if the examination is a long one, he should not be allowed to move for some hours afterwards, and especial care must be taken to guard against exposure to cold. A gentle purge given the evening before, to ensure the lower part of the bowel being emptied, tends to diminish the amount of local irritation.

The length of the prostatic portion is measured by means of a catheter. The distance the instrument has to pass before the point enters the membranous part is noted, and that at which the urine begins to escape; the difference corresponds roughly to the length required.

Two points must be remembered in doing this. One is that the measurements are not taken from the same part of the catheter. In a large-sized instrument, such as is usually employed in cases of enlargement of the prostate, there may be more than a c.m. difference between the eye and the end. The other is that if the prostatic urethra is dilated a few drops of urine always flow from it as soon as the catheter enters the cavity. If the communication with the bladder remains open the whole of the urine can be drawn off in this way. The result, therefore, requires checking before it can be accepted as absolutely correct.

Every form of prostatic enlargement may be accompanied by increase in the length of the prostatic urethra. This measurement, therefore, does not add much to the information obtained by rectal examination. On the other hand, all the symptoms of prostatic obstruction may occur without alteration in the length of the urethra. If the stroma-growth begins early in the course of the disease, before the adenomatous tissue has spread to any extent, the gland increases in density without undergoing any material change in size. In such a case the prostate becomes as hard as scirrhus, and the structures around the neck of the bladder are so rigid as to render the passage of urine exceedingly difficult. In one of these cases McGill was unable to remove a fragment larger than a pea. The mere fact, therefore, that the length remains normal is not to be taken as an indication that the prostate is not affected.

The direction of the urethra is equally important. The curve

may be increased or lessened. It may deviate to one side or the other, and it may be uniform throughout, or sharply bent at one point and almost straight in the rest of its course.

Lateral deviation is shown at once by the twisting of the handle of a metal instrument as the point passes by the obstruction. It may be caused either by unequal growth of the lateral lobes, or, if the twisting takes place as the instrument is entering the bladder, by the projection forwards of a median upgrowth in the posterior margin of the vesical orifice. Exceptionally the urethra is so tortuous from the presence of nodular projections fitting into each other that there is some difficulty in introducing a rigid instrument.

Angular bending is shown by the way in which an ordinary catheter is caught and stopped at a point from two to three c.m. beyond the membranous portion, while an elbowed one, or a gum elastic from which the stilet is withdrawn when the obstruction is reached, passes with ease. Bending in this situation is proof of the presence of a growth in the posterior wall of the upper part of the urethra. Increased lengthening at the same time is proof that the upgrowth has raised the neck of the bladder as well, and extends into the orifice.

Further information with regard to this may be obtained by observing the extent to which a metal instrument requires to be depressed between the patient's legs when he is lying down. If the handle of a full-sized prostatic catheter has to be lowered almost to the horizontal before the point enters the bladder the curve of the urethra is not only of exceptional length, but is so directed that the orifice looks towards the pubes, or, at least, towards the anterior abdominal wall, not upwards as it should. In other words, there is a great upgrowth behind it, and beginning to project over it.

A short-beaked metal sound is of use for ascertaining the presence of a cavity in the prostatic urethra and the shape of the vesical orifice. The curve must be bent so that the tip is at right angles to the shaft, and should not be more than an inch in length. If the walls of the urethra are in contact and there is no cavity the point can only be moved backwards and forwards. In any other direction it meets with an immediate check, and the attempt is stopped by pain. If, on the other hand, there is a cavity, it can be made to rotate from side to side, and move about with freedom.

In some cases there is a space capable of holding several drachms of urine.

The shape of the orifice.—Outgrowths springing up around the orifice of the bladder can be detected in the same way. If the margin is smooth and even the curve of the sound sweeps round it without difficulty. When, on the other hand, it is irregular, with projections here and there, the difference in level is felt immediately. A uniform collar-like upgrowth may be suspected when the length of the urethra is increased while the margin remains level. If rotation from side to side is stopped as the point approaches the median posterior line there is in all probability a single, and, perhaps, a valve-like upgrowth. A fairly correct estimate as to the size and degree of mobility can sometimes be formed in these cases by noting the additional length to which the sound must be introduced before it can pass over it, and the sharpness of the jerk with which it slips past.

A valvular outgrowth is to be suspected when the bladder retains its power, but is unable to get rid of its contents, while a catheter passes in without difficulty. The diagnosis is confirmed by introducing a catheter with a terminal orifice down to the apex of the prostate and connecting it by a rubber tube with a funnel containing warm boracic solution. Under normal circumstances a pressure of a few inches is sufficient to make the fluid enter the bladder. Roughly, the measurement may be taken by the height to which it is necessary to raise the funnel. If greater accuracy is desired the tube may be connected with a manometer by means of a side branch. In cases of valvular obstruction, the fluid enters freely at the ordinary pressure. If, on the other hand, retention is due to congestion and compression of the urethra by the lateral lobes it remains stationary until the funnel is six feet or more above the patient's body, and then it only trickles in. Occasionally the resistance is so great that it cannot make way. I have found this method of use in several instances in confirming the impression derived from exploration of the orifice with a sound.

By combining rectal with urethral examination a very accurate estimate can be formed of the amount of growth in the median posterior line. The shaft of the instrument can always be felt at the apex of the gland, and if it is reversed, and the parts are normal, the point can be felt equally well in the bladder.

In some cases growths that surround the orifice can be seen by

means of a cystoscope, but so far as enlargement of the prostate is concerned this instrument has not fulfilled the expectations formed of it. In many instances it is very difficult to introduce. It is almost impossible to see with it the bases of the growths. They may be broad or narrow, pedunculated or not; owing to the way in which they fit closely together, only the summits are visible. And it can give no information about growths in the posterior wall of the urethra, or the density that the enlargement has attained. On the other hand, when it can be introduced it is of considerable service in ascertaining the condition of the mucous membrane of the bladder and the presence of sacculi.

Another method that I have found of great assistance in forming a diagnosis is based upon the relation that exists between the size and shape of the prostatic urethra and that of the prostate itself. It is true that this must not be pushed too far. The prostate may be distorted and covered with outgrowths without of necessity entailing much alteration in the channel that runs through it. But leaving on one side cases that present conspicuously exaggerated features, and restricting it to the ordinary type of overgrowth, in which there is an ever-increasing difficulty in emptying the bladder, some degree of proportion certainly does exist in the majority. It is true that it is not possible to define accurately in every case the parts that are enlarged or the extent to which they have grown, but it is equally true that great alterations in the dimensions of the urethra are practically always associated with definite changes in the shape and size of the gland.

Measurements should be taken in the middle of the prostatic urethra, and at or as near as may be to the vesical orifice. The former are the more valuable. When the alteration in size or distensibility at the outlet is very marked the shape of the gland is usually too irregular for accuracy. The opening, for example, may be distorted into a semi-lunar shape by the growth of a median projection from behind, and give an antero-posterior diameter that is altogether deceptive. In the middle of the prostatic urethra this rarely happens. In this part an increase in the antero-posterior diameter, without any great change in the transverse one, always indicates overgrowth of the lateral lobes. If the measurement diminishes rapidly towards the bladder, and if the urethra is at the same time increased in length, not only are

they enlarged, but they have raised up between them a fold of mucous membrane across the posterior boundary of the outlet. And if there is at the same time a distinct angle in the posterior wall, stopping the passage of an ordinary catheter, the fold is of considerable thickness, projecting forwards as well as upwards, and contains an outgrowth of glandular tissue. In other words, the vesical orifice is raised, displaced forwards, and surrounded either by a continuous collar or by projecting eminences which meet together over it when the bladder contracts.

The lateral diameter deserves an equal amount of attention. Normally the transverse section of the prostatic urethra, about its centre, is crescentic in shape, with the convexity forwards. When there is general enlargement this is altered to a tri-radiate star. Increased width is a sure indication that there is overgrowth in the posterior wall, involving the urethra, if not the vesical outlet.

It is more difficult to ascertain the extent to which the urethra is displaced in the substance of an enlarged prostate. Usually there is very little increase in front, but I have met with one instance in which this was so great that the channel lay a long way behind the centre. In another, in which prostatectomy was performed, it is recorded that the anterior growth was the main and almost the sole obstruction (Wishard, "Journal of Cutaneous and Genito-Urinary Diseases," March, 1892). It may be suspected if, when the prostate is distinctly enlarged, the antero-posterior diameter of the urethra is not increased, and the canal is unusually straight.

Messrs. Mayer and Meltzer have made for me a modification of the ordinary form of urethrameter, which I have found exceedingly useful for this purpose. There are two forms of it. Each consists of a diamond-shaped metal frame, hinged at the four angles to allow of expansion and contraction, and enclosed in the curve of a prostatic catheter, part of the wall of which has been cut away. In the one the sides are open to allow of lateral expansion; in the other the front and back for antero-posterior measurement. The projecting angles in each case are protected by little rounded buttons, so that the mucous membrane may not be hurt or bruised. Expansion and contraction are effected by means of a stilet gliding backwards and forwards in the shaft and terminating in a finger ring. The measurement scale, which is marked upon the handle of the stilet, gives at a glance the width

to which the frame is expanded at the moment. By means of these, introducing first one and then the other, the interior of the prostatic urethra can be mapped out with perfect accuracy, and in many instances, owing to the difference in the resistance presented by the walls, the density of the growth can be ascertained as well (Paper by author, in "Lancet," December 17th, 1892).

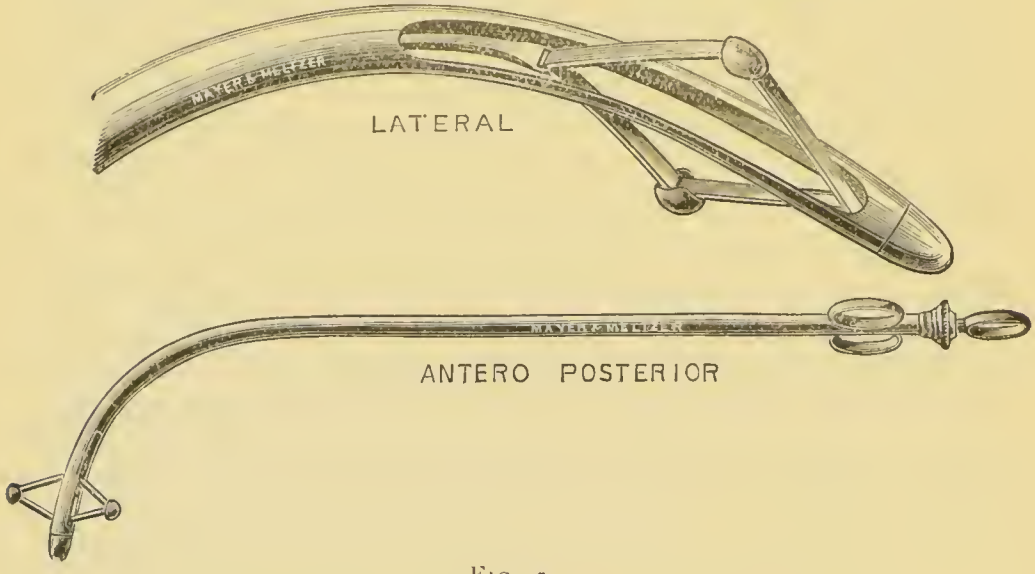


Fig. 5.

THE STATE OF THE BLADDER AND KIDNEYS.

Enlargement of the prostate derives all or almost all its importance from the influence it exerts upon the bladder and kidneys. The diagnosis, therefore, cannot be considered complete until an estimate has been formed of the effect it has produced upon the urinary organs. The amount of residual urine, the condition of the mucous membrane of the bladder, the tone of its muscular wall, and the secreting power of the kidneys must all be ascertained before a definite line of treatment can be adopted.

The amount of residual urine is estimated by passing a catheter after the patient has emptied his bladder so far as he can. This must be done on several occasions, and under different circumstances, before forming a definite opinion. Patients rarely face an examination of the urethra unless the symptoms have been growing rapidly worse of late. And partly because of this, partly from nervousness, it often happens that the amount appears to be larger than it really is. Not unfrequently the tone of the bladder improves, and the quantity diminishes considerably in the course of a few days.

Residual urine should never be drawn off when the patient is standing upright. If the heart's action is weak, syncope may be very easily caused by suddenly lowering the abdominal pressure.

If the amount is over a few ounces, six or eight, the bladder must not be emptied. If more than this is drawn off the deficiency must be made up by injecting either some dilute antiseptic or boiled salt and water, approximately of the same specific gravity as the urine. When there is a large amount of residual urine the kidneys are always affected, and their action may be very seriously interfered with by shock. The mere passage of a catheter, though every precaution is taken, is under such circumstances a serious operation.

This effect is probably due to inhibition of the nerves of the renal plexus. Shock affects these in the same way as it does at times the nerves that supply the wall of the bladder. Sometimes partial suppression follows, sometimes polyuria. I have known as much as seven pints of very low specific gravity (1006) passed in the twenty-four hours by a patient from whom it had been necessary to draw off the residual urine in three days. In either case the condition is very grave.

The tone of the muscular coat of the bladder and the strength with which it can act are best estimated by watching the changes in the amount of residual urine, and the force with which the stream is propelled through a full-sized catheter. When the tone is good, it is ejected vigorously without any conspicuous exertion on the part of the abdominal muscles, and it retains its strength to the end. When, on the other hand, the muscular coat is failing it flows away quietly, rising and falling with the respiratory movements, and if the patient is lying down and does not cough or make any particular effort the last few ounces of urine are only expelled when pressure is made with the hand over the pubes. Very often the stream stops long before the bladder is empty, and begins again when the catheter is pushed in a little farther or drawn a little back. The bladder no longer contracts uniformly from all sides on to the orifice, expelling its contents to the last drop. It collapses and falls into loose folds, which hang down over the opening, and leave a pouch filled with urine behind.

A definite opinion as to the extent to which the bladder has lost tone cannot be formed from a single examination. Over-distension, for example, makes it so much worse for a time that a wrong impression is easily formed. The first few ounces when a catheter is

passed in such a case may be expelled with vigour, owing to the elastic recoil of the tensely stretched wall. As soon as this is spent the rest of the urine flows away as if the bladder were absolutely powerless. When the distension has been extreme there may be no evidence of muscular action for days. After a while, however, the bladder begins to recover, and though the tone is seldom quite so good as it was before, especially if there used to be much residual urine, a great deal of it may be recovered.

Allowance, too, must be made if a catheter has been constantly employed for some time past. The persistent use of a catheter seriously weakens the power of the bladder. The muscular fibres, relieved of all work, undergo degeneration, and when called upon no longer possess the strength. It has been said that recovery of the power of voluntary evacuation is impossible after the habitual use of a catheter for two years : that after so long an interval the muscular coat can never regain what it has lost. It is probable, however, that the permanent character of the loss depends a great deal more upon whether there has been cystitis or not. If inflammation has never broken out or has never been sufficiently severe to affect the muscular layer, the power of contraction can be recovered after a much longer interval than this. Instances in which voluntary control has been regained after an interval of six and even seven years are on record. There is a material difference between the loss of tone that results from disuse and that which is caused by inflammation. The bladder will recover from the one if the patient's general health is good ; the muscular fibres have not been destroyed. The other is undoubtedly sometimes permanent.

The capacity of the bladder again must be taken into consideration in estimating the tone retained by its muscular wall. It may be able to deal satisfactorily with a small quantity of urine and fail with a large one, the fibres becoming tired out before their work is finished. A bladder that can only hold a small amount of urine is able to contract efficiently with much less expenditure of strength than a large one. The length of time through which the muscular coat is able to maintain a state of active contraction, however slight, is probably the best test of its condition. I have tried by means of a manometer attached to the side of a catheter to obtain a more accurate record of this, but the result has not proved satisfactory. The novelty and the amount of apparatus prevented, it seemed to me, the patient from doing himself full justice.

The condition of the mucous membrane of the bladder is not difficult to ascertain. In many instances it can be inspected, if it is wished, through a cystoscope. When it cannot the appearance and reaction of the urine, the frequency of micturition, and the severity of the pain that accompanies it furnish ample proof.

The amount of mucus and blood and the character of the epithelial *débris*, added to the urine while in the bladder, are the best guides. A light floating cloud of detached epithelial cells, entangled in mucus, tells at once that the surface is congested and swollen. Turbid urine, stained with blood, and filled with floating shreds of young epithelial cells, pus corpuscles, and red blood corpuscles held together by filaments of fibrin, never occurs unless the surface is acutely inflamed. A large amount of blood may be caused by the presence of a growth or by the passage of instruments. If it occurs in the absence of these conditions either there is intense congestion or rupture of a dilated varicose vein. When the reaction of the urine is natural, but after standing some little time a dense greyish layer of pus and mucus collects at the bottom of the vessel, the surface is in a state of chronic catarrh. The mucous membrane is swollen and thickened. The epithelium that covers it is heaped up in many layers. The cells are badly developed and melt away and disappear before they are fully formed. They are no longer able to protect the softened and œdematous structures beneath; and if septic organisms gain entrance into the bladder further changes quickly follow. Often in these cases the urine has a faint and most unpleasant odour, and not unfrequently the colour is very much darker than natural.

If the urine is ammoniacal, and if after standing an hour or two a slimy tenacious mass of mucus and pus mixed with earthy and triple phosphates settles down to the bottom and clings to the side of the vessel when it is inverted, the cystitis is of a much graver character. Septic organisms have penetrated into the substance of the wall. The interior is coated over with a deposit of similar character to that which collects after the urine is passed. Underneath it the surface is raw, ulcerated in places, so that it bleeds at the slightest touch, and stained by hæmorrhages. All the coats are in a state of intense congestion; the fibrous tissue is swollen and softened; the interstices everywhere are filled with inflammatory exudation; many of the vessels are blocked; and the muscular fibres are beginning to degenerate.

Decomposition of the urine marks a definite stage in the life-history of a case of enlargement of the prostate. The mucous membrane may be congested or inflamed. There may be retention of urine and atony. The muscular coat may be seriously weakened from disuse and chronic congestion. So long as decomposition does not occur and the inflammation is not septic, the wall of the bladder, if the cause is removed and the patient not too infirm, is, in the vast majority of instances, capable of recovery. When septic cystitis sets in, unless it is checked at once, neither the bladder nor the kidneys can escape without permanent injury.

Long-standing difficulty in micturition without much residual urine is suggestive of fasciculation of the wall. Sudden and unaccountable changes in the quality and quantity of the urine, and the slipping of a catheter into another collection of urine, after it has apparently emptied the bladder, usually indicate the presence of sacculi. These conditions, however, and the state of the orifices of the ureters can only be made out for certain by the cystoscope.

Increased frequency of micturition without pain is a sign of distension and residual urine. When pain is present with it, the mucous membrane at the neck of the bladder is congested or inflamed, and the degree of urgency may be taken as the measure of the changes this has undergone. So long as it is not very great there is merely a certain amount of hyperæmia; the surface is not broken. Strangury, burning pain at the neck of the bladder, spreading down to the end of the penis, and accompanied by spasmodic ejection at frequent intervals of a few drops of urine, never occurs without some intense source of irritation, such as calculus or inflammation. In the worst cases there is often a small ulcer or fissure between the folds of mucous membrane at the neck, causing pain and kept from healing by the spasm it excites, much in the same way as the same complaint in the neighbouring bowel.

The condition of the kidneys requires to be very carefully investigated in all cases of enlargement of the prostate. The signs of renal degeneration in its earlier stages are very vague and ill-defined. Failure in health and strength without any obvious cause, loss of energy, emaciation, and the sudden assumption of the aspect of old age are highly suggestive. The patient is always catching cold and is upset by apparently trivial causes. The hair turns grey rather suddenly, the skin grows harsh, the

tongue becomes dry and coated, and the appetite capricious. Feverish attacks are common, and the patient complains that he is always suffering from vague pains across the loins, and that he is never really well. The urine is examined, and the amount passed in the twenty-four hours is found to be unduly large and the specific gravity unduly low. There is no albumen, however, and although fibrinous casts may be occasionally detected, they are by no means common.

The mere diagnosis, however, of renal degeneration is not sufficient. The cause must be found out as well. It may be a symptom of general arterial sclerosis, or it may be the consequence of persistent irritation and congestion arising reflexly from the condition of the other urinary organs. It may be of constitutional or of local origin, or of both together. The effect, so far as the urine is concerned, is almost the same, although it follows more slowly in the one than in the other; the symptoms are closely similar; there is with each the same premature old age; but the one is dependent upon a cause that cannot be removed, however much its consequences may be averted, the other upon a cause that sometimes can.

When the two occur together, which is not unfrequent, the difficulty of assigning the proportionate share to each is, as might be expected, very much greater.

Careful comparison of cause and effect, especially of the relative time at which the symptoms have made their appearance, enables an opinion to be formed in most cases. In some the urinary obstruction is of recent date, the amount of residual urine is out of proportion to the size of the prostate, the general symptoms are well-marked, and there is evidence in other parts of the body of the vascular and other changes usually associated with arterial degeneration. In others the prostatic symptoms are distinct and old-standing, while the arteries that are accessible to observation show little or no evidence of disease. In the former case the renal degeneration may be of constitutional origin, in the latter it is much more likely to be local.

I have not been able to find any constant relation between the consistence of the enlarged gland, as felt through the rectum, and the presence of arterial degeneration. It has been said that in markedly atheromatous patients the prostate undergoes fibroid transformation at a comparatively early stage of enlargement, and

that, consequently, it never attains any conspicuous dimensions, although this does not prevent it becoming a serious source of obstruction. Such a coincidence is, however, by no means invariable, and it must be regarded as a coincidence only. I have met with enormous adenomatous growth in patients whose arteries were distinctly atheromatous, and conversely with a gland of almost scirrhous hardness when the vessels were to all appearance perfectly sound.

The onset of septic nephritis is shown by the effect that it has upon the urine, and by the increased severity of the constitutional symptoms. The presence of casts of various kinds, the increase in the amount of albumen and the diminution in that of urea are the most significant of the changes in the former independently of those that arise from the inflammation of the bladder. Rapid loss of flesh and strength, failure of mental energy, incipient delirium (especially at night), vomiting, anorexia, with a dry, red tongue, irregular temperature, and a quick, feeble pulse are the most characteristic of the latter.

CHAPTER VII.

THE GENERAL TREATMENT OF ENLARGEMENT OF THE PROSTATE.

The general treatment of enlargement of the prostate deserves more consideration than it usually receives. The occurrence of acute complications, such as retention of urine and cystitis, in a large proportion of cases can be traced back directly to an attack of prostatic congestion arising from some act of carelessness.

Diet is of great importance. By the time the patient has reached the age at which prostatic obstruction usually causes symptoms he ought to know what agrees with him, and should confine himself to that. But most people are so constituted that definite rules are necessary.

Meals should be light and frequent. Long and late dinners with many courses are most injurious. The plainer and simpler the diet the better. Rich food, highly-dressed dishes with elaborate sauces, and a great variety of food at the same meal should be strictly avoided. Most attacks of prostatic retention originate in what is popularly called congestion of the liver.

Meat and highly nitrogenous foods, such as cheese and eggs, should be partaken of very sparingly. Most people consume daily a great deal more than they require. So long as the patient is leading an active, vigorous life the excess may be disposed of without leaving any apparent effect, but as a rule the amount of exercise taken each day, and the energy with which it is taken, begin to diminish about the time when prostatic symptoms grow troublesome. The requirements grow less, and the ability to dispose of any surplus without inconvenience disappears.

This caution is especially needed when the urine is highly acid, and inclined to deposit crystals on standing. Owing to the congestion at the neck of the bladder the mucous membrane is intensely sensitive. The least excess of acid in the urine irritates it at once, and by causing increased frequency of micturition makes the congestion worse. Fish, poultry, and game do not appear to have the same tendency, and should be used as far as possible as substitutes.

Ripe fruits and vegetables, except such as tomatoes, rhubarb, and asparagus, which have a very definite effect upon the urine, may be taken in reasonable amount. They tend to keep the action of the bowels regular, and diminish the acidity of the urine. Care, however, must be taken that this is not carried too far, and that it is not rendered alkaline. Highly-spiced or salted articles of diet, pastry, and sweet dishes generally must be avoided.

The quantity of fluid taken daily is to a great extent a matter of personal habit acquired during previous life. Many patients, especially when the kidneys are beginning to fail, require and are better for a large amount. Others can do with very little. Quantity has some influence upon the frequency of micturition, but this depends much more upon the amount of residual urine, and the condition of the mucous membrane at the neck of the bladder. A glass of hot water, taken the last thing at bedtime, sometimes diminishes the number of micturitions in the night by making the urine less concentrated and less irritating. On the other hand, when the urine is already very dilute, it may make matters worse.

Alcohol in small quantities, and taken at meal time, is generally beneficial to those who have been accustomed to its use. It enables them to make the best use of their food with the least expenditure of energy. It should never be taken except with food, and should not be taken the last thing at night. The particular form must depend upon the individual, but, speaking generally, the more diluted it is the better. Champagne, sherry, and beer are, perhaps, the most generally injurious. Whisky and gin enjoy the highest repute, but they must be old. There can be no question that newly-fermented wines and spirits are not good.

Milk may be taken freely by those who can digest it well. If the quantity at first is small and it is increased slowly, exceptions are not often met with. Coffee is irritating to many people. The question of tea depends upon the length of time it is allowed to stand and the amount of tannin it contains. Hard water should be avoided. The salts of lime that it contains are partly excreted as oxalates in the urine, and crystals of oxalate of lime are especially irritating.

The bowels should never be allowed to become constipated. Straining has almost as great an influence upon the prostatic plexus as it has upon the hæmorrhoidal. Great care must be taken in the choice of laxatives, avoiding those that are liable to increase

the congestion of the rectum, changing them frequently and combining them with tonics. Active purgation is as injurious as constipation. In the later stages, when the bowel has lost its tone, and the control over the sphincter is failing, there is always a tendency to hæmorrhoids and prolapse. If this occurs the irritation spreads to the neck of the bladder, the frequency of micturition is greatly increased, and the patient's condition may become one of extreme misery.

Clothing must be warm but light, flannel, silk, or merino being worn next the skin. At the same time excess must be carefully avoided. Overclothing is scarcely less injurious than the reverse. Patients with enlargement of the prostate are peculiarly susceptible to chills if they are tired or overheated, and the least chill may cause retention of urine. The loins especially must be well protected, and the lower extremities kept warm, and, above all, dry.

Hip-baths as hot as can be borne, just before getting into bed, are sometimes of service in relieving the irritability at the neck of the bladder; but immersion should not be prolonged for more than a minute or two. In the morning the temperature of the bath should be guided by the energy with which the circulation reacts. Light general friction afterwards is very beneficial from the influence that it has upon the blood supply of the skin.

Exercise in moderation is essential, but it must be of a kind that is suited to the condition of the patient. It helps to maintain the general health; prevents attacks of local congestion, and keeps the liver and the bowels in good order. The age and the physical condition of the patient must, of course, be carefully considered, and exercise must always stop short of fatigue. Riding, long railway journeys, and anything that tends to increase the congestion of the pelvic organs must be prohibited. When for any reason exercise cannot be taken, general massage is an excellent substitute, maintaining a high standard of activity for both the circulatory and excretory organs.

No drugs have the least influence upon the rate of growth of the gland. Some, however, are of service in helping to maintain the tone of the bladder and in controlling the reaction and the concentration of the urine.

Ergot and nux vomica have the highest reputation. Of the latter there can be no doubt. When the tone of the bladder is

failing it is of great value, whether given by the mouth, or as strychnia, hypodermically. Ergot, on the other hand, is probably useless. It was given originally because of its action upon the gravid uterus and the homology that was supposed to exist between that organ and the prostate. But it has never been proved to have the slightest influence. Professor White, who states that he does not feel inclined to discard it altogether, on account of the improvement that he has noted in some cases that were taking it (in combination with other drugs and other treatment), admits, first, that it is indicated in only a small proportion (those in which the softness of the enlargement suggests the predominance of muscular elements), and next that it is far from being demonstrated that it has any distinct effect even then.

Belladonna should never be given in cases in which the tone of the bladder shows the least sign of failing. And the same statement must apply to hyoscyamus and conium, although the effect that they produce is very much less important.

A large number of drugs on the other hand have marked influence upon the urine, and so indirectly upon the urgency and persistence of the symptoms.

Excess of acidity leading to the deposit of uric acid crystals or of acid urates, and causing increased frequency of micturition, can be met in this way. In many instances it is dependent, more or less immediately, upon the condition of the liver, and can be rectified at once by small doses of blue pill or calomel. Simple dilution, increasing the quantity of fluid taken during the twenty-four hours, is occasionally sufficient. It has been shown experimentally to have a distinct effect upon the discharge of nitrogenous waste. If this fails the acidity can be controlled by the administration of alkalies, citrate of potash, or lithia, for example; or the liquor potassæ or the bicarbonate of soda, well diluted. Care, however, must be taken not to carry the change in reaction too far; alkalies should never be given as a routine treatment in irritability of the bladder.

Generally speaking it is advisable when the urine continues to be unduly acid to stop the consumption of sugar for a time, and, if the patient feels the deprivation, to substitute saccharin. Piperazin, in five-grain doses, three times a day, I have found of considerable value, especially when there are numerous uric acid crystals. Some small part of the benefit may be due to its influence as a

diuretic, for the amount of urine passed when fifteen grains a day are taken for any length of time is considerably increased.

Alkalinity of the urine may be dependent upon decomposition of the urea in the bladder, and later in the pelvis of the kidney; or upon excess of fixed alkali at the time of secretion. In either case it should be checked as soon as possible. It favours the growth of pathogenic organisms; it makes the bladder more irritable, and increases the amount of mucus secreted; and it leads to the precipitation of the phosphate of lime, and when the urea decomposes of the ammonio-magnesian phosphate as well, so that calculi and incrustations form upon the wall of the bladder and in the pelvis of the kidney.

Very little can be done for urine that is alkaline at the time it is secreted. In most instances, unless the reaction is merely of a temporary character, as, for example, during the period of active digestion, it is evidence of some grave disorder of assimilation or metabolism, and the treatment of the urinary affection must be subordinated to that of the general symptoms. The drugs that are of most avail for increasing the acidity of the urine are boric acid, which may be given in seven or ten-grain doses three times a day, and benzoic acid or, because it is more soluble, benzoate of ammonia. If the two latter, as sometimes happens, disagree with the patient and upset digestion they may be given in ten-grain doses in capsules that will pass unaltered through the stomach into the intestines, or as Belfield recommends with borax and boric acid, three grains of each, four to six times a day. Mineral acids are of no use except in so far as they act as tonics and improve the general health; and the organic acids for the most part make matters worse.

Alkalinity arising from ammoniacal decomposition, on the other hand, is of local origin, and is to be met by local measures mainly. A certain amount of benefit, however, is derived from drugs that increase the acidity of the urine, or act as antiseptics. Boric acid, seven to ten grains three times a day, and salol, in cachets containing five grains, two night and morning, have proved of most value in my hands. Even when the cause is a permanent one they tend to check decomposition, and, as soon as this is under control, the alkalinity disappears. Quinine, independently of its general therapeutic value, has considerable influence on urinary fermentation, probably owing to its bactericidal powers; and though they

cannot replace salol and boric acid, salicylic acid and salicylate of soda are sometimes of use in the same way.

Catarrh of the mucous membrane that lines the urinary passages can be checked by small doses of turpentine and other resins given in capsules. Sandal wood and eucalyptus oil, are the least objectionable, but copaiba, with cubebs, sometimes answers better than either of them. Probably the benefit that has been observed to follow the administration of buchu is due to the volatile oil it contains. Belfield speaks favourably of an emulsion consisting of small doses of turpentine, powdered cubebs, and belladonna, and of pichi (Extr. Fabianæ liquid, ♏ x. to ♏ xxx.). The liquid extract of Collinsonia Canadensis has also been recommended ("Lancet," May 5, 1888).

Of the large number of other drugs that are frequently given in this condition, such as pareira, uva ursi, triticum repens, etc., it is very difficult to say anything definite. Undoubtedly a certain amount of benefit is often experienced while they are being taken, but it is very difficult to say whether it is due to any action that they possess, or to other remedies taken with them, to local treatment, to better observance of ordinary dietetic rules, or to mere dilution. On the whole the positive evidence in their favour is very small.

CHAPTER VIII.

THE LOCAL TREATMENT OF ENLARGEMENT OF THE PROSTATE.

Palliative Measures: The Maintenance of the Urethra—The Prevention of Retention and of Residual Urine—The Prevention of Irritability of the Bladder and Cystitis.

The local treatment consists either in removing the outgrowth that causes the obstruction, or in leaving it alone, adopting palliative measures, and meeting the various complications as they arise.

PALLIATIVE MEASURES.

The aim in view is to maintain a clear and open route through the urethra; to avoid the collection of residual urine and the occurrence of retention; and to prevent irritability of the bladder and cystitis.

If this can be accomplished more energetic measures are not needed.

1. *The maintenance of the urethra.*

In the early stages of the disease a certain amount of benefit may be obtained by mechanical dilatation, passing full-sized, highly polished steel sounds, and leaving them *in situ* for a quarter of an hour or twenty minutes. They must be as large as the membranous portion of the urethra will admit, and must, of course, be used with the greatest gentleness.

They have no influence upon the rate of growth. This increases as fast or as slowly as it did before. All they do is to compress the mucous membrane, empty the blood vessels, and prevent the walls of the urethra being continually squeezed together. I have found them of service when the lateral lobes are enlarged and the urethra flattened, and when there is risk of retention owing to insufficient muscular hypertrophy. The stream in these cases is never good, though the amount of residual urine is often small. In many such radical treatment is either inadmissible or cannot be strongly urged. If the wall of the bladder can be saved, before it

has been overstrained, by rendering the outlet a little more easy, atony may be prevented, or at least postponed.

It is only when the rate of growth is very slow that sounds can be expected to do any good. And even then it must be insisted that their effect is only beneficial for a time. As the patient grows older the obstruction becomes greater and the muscular power less; and at length, even if cystitis is warded off, sounds have to be replaced by catheters with all the risk of infection in an enfeebled bladder. They are only palliative at the best, and that in a few cases, and only so long as the changes are slight.

Harrison ("Brit. Med. Journ.," 1882) is convinced of the efficacy of this method of treatment, especially in cases in which the gland is lobulated and channels along which the urine can find its way are left between the masses. He recommends gum elastic instruments from two to four inches longer in the stem than usual, with an expanded portion an inch from the tip. According to him there is no evidence that instruments of this kind, used with sufficient care, cause any irritation. The prostate is a most long-suffering organ, and the enlargement can be moulded by the pressure so as to prevent obstruction.

Prof. White also ("Annals of Surgery," 1893) speaks highly of it: "A patient who presents the symptoms of the prostato-vesical congestion of the early stages of hypertrophy, who is disturbed once or twice at night, who has an enlargement of moderate density, appreciable through the rectum, but not offering much resistance to the introduction of an ordinary catheter, and who has but little residual urine, is likely to derive great benefit from the systematic introduction of full-sized steel sounds. I have always under observation a number of such patients in whom this treatment, and this alone, seems to relieve existing symptoms, and to prevent, or, at least, delay the development of further trouble. That it can have any true curative effect is unlikely; that it can even modify to any extent the continuous enlargement of the gland seems improbable, but that, either by producing a local atrophy in the parts immediately surrounding the urethra, or by simply stretching the canal itself and relieving local congestion and tumefaction, it mitigates the early symptoms, lessens the vesical irritability, diminishes the amount of residual urine, and modifies favourably the whole course of the case, seems to me beyond all

doubt, and I base my opinion upon a fairly large experience, extending now over nearly twenty years.

"In carrying it out, I prefer to introduce every fifth day the largest steel sound which the membranous urethra will permit to pass, and of allowing it to remain in place for ten to fifteen minutes, or longer if the patient is in bed. Careful sterilization of the instrument and gentleness in its introduction render the treatment absolutely free from objection, and intelligent patients carry it on for themselves for years."

Prof. White even suggests the advisability of over-stretching the prostatic urethra in cases of lateral hypertrophy in which the canal is narrowed or rendered tortuous. It must be done under ether, and be carried to the farthest degree consistent with safety. The grounds upon which he relies are the success that in his hands has attended dilatation with sounds; the fact that the prostate has not uncommonly been found to be atrophied in cases of stricture; and that the previous attempts in this direction were made at a time when antisepsis in genito-urinary surgery was unknown.

That the prostatic urethra is capable of considerable dilatation without laceration of the mucous membrane is undoubtedly true. The fore-finger, if an opening is made in the perineum, can be passed through it without the least difficulty. But putting aside the risk always attendant on forcible stretching of the urethra, that it could have any influence on the progress of the growth, even if it were carried out every week, is very doubtful. The comparison with the atrophy that is occasionally found in cases of stricture, even if this is due to the mechanical pressure exerted by the urine, is not a very close one.

2. *The prevention of retention.*

Inability to empty the bladder may arise from failure in the expulsive power, or increase in the resistance, or from both together. The object of palliative treatment is to restore the normal balance without operation.

a. *The treatment of the loss of power.*

Diminution in the strength of the muscular coat of the bladder may arise from various causes.

It may be induced by one single act of extreme distension—atony in the strict sense of the term. This may occur even in

young men from prolonged voluntary retention of urine. In older men, suffering from enlargement of the prostate, it is far more common, but then there are usually other causes at work as well. Generally speaking, if the urine is drawn off at regular intervals, and the bladder is allowed time to recover itself, loss of power caused in this way slowly passes off. But it may be permanent, even in young men, and in old ones it almost always leaves behind it some degree of permanent disability.

Disuse is another cause, the muscular fibres undergoing degeneration. This is one of the necessary consequences of the habitual employment of catheters. The muscular coat of the bladder, never doing any work, gradually loses the power of working. The prognosis, if there is no other reason for the loss of power, is good; the bladder, as McGill has proved, may recover even after many years of habitual catheterism.

Malnutrition is another. Age and atheroma lead to the decay of the muscular power of the bladder, as of all other organs. Or the cause may be a local one—chronic congestion, for example, due to prolonged straining, or persistent inflammation.

Nearly always there are several of these causes at work together.

Over-distension or anything that might throw the least extra strain upon the bladder must be carefully avoided. If the loss of power is complete a catheter must be passed at regular intervals; if it is only partial, if, that is to say, there is a certain amount of residual urine, it must be passed two or more times a day, according to the quantity. The patient may be encouraged to expel the urine through the instrument as forcibly as he can, with the view of exercising the muscles of the bladder against a resistance that they can easily overcome; but much must not be expected from this. It is nearly always the abdominal muscles that are employed.

Strychnia, as already mentioned, is of undoubted service. It may be given by the mouth with iron, the mineral acids, and other tonics, or hypodermically. Hydrastis canadensis is highly spoken of, and also ergot. It is doubtful if injections of ergotin and sclerotic acid are of the least use. I have seen them tried on several occasions, but never with any benefit.

Cold douching over the abdomen and loins night and morning, and massage applied to the lumbar region, are beneficial at times. The effect is probably due to the increased activity of the circulation through the nerve centres, or to the improvement in general

muscular vigour, rather than to any influence upon the bladder itself. The bladder may be washed out with cold water through a catheter, but the effect is not sufficiently sudden to excite muscular contraction. If it is tried great care must be taken not to distend the cavity. Cold applications to the rectum are only of use when there is active congestion or inflammation of the gland.

Electricity ought to be of service, and has been tried on many occasions, but the cases in which it has succeeded are few and far between, and it is said to have caused serious irritation of the mucous membrane. A slowly interrupted current is the most suitable, reversed from time to time. One pole is placed over the lumbar region, the other over the pubes, in the rectum, or by means of a properly-contrived bougie-electrode in the bladder. The urine in this case is drawn off first, and a sufficient quantity of salt and water injected to unfold the walls.

b. *The treatment of the obstruction.*

When the bladder cannot be emptied because of the obstruction caused by the prostate, and radical measures are inadmissible or are declined, the symptoms must be relieved by the use of catheters.

The kind of instrument depends upon whether it is used by a surgeon for purposes of diagnosis or to overcome some difficulty, or by the patient as a matter of routine. In the former case a metal instrument is to be preferred, in the latter the softest that can be introduced. Whatever material they are made of, the eye should be perfectly smooth and rounded; the end beyond the eye should be solid, so that there is no receptacle to collect dirt, and the interior should be as smooth and polished as the exterior. If it is necessary in the one case in order that there may be the least possible amount of friction, it is equally necessary in the other that the urine may not soak into the fabric of the instrument or cling to the irregularities on its surface.

Red rubber ones are the softest. In many cases, however, they will not pass; either there is an elevation on the floor, which they are unable to surmount, or the sides of the urethra are so closely pressed together that the catheter cannot separate them.

Black ones, stiffened at the end and bent upwards at the point (coudé or bi-coudé), are the most generally useful. If they fail, an English gum elastic, that has been kept for some time over-curved upon a stilet, will generally succeed; or Hey's well-known

plan may be tried of passing the catheter down to the obstruction, withdrawing the stilet and, at the same time, gently pressing the instrument onwards.

Olivary French catheters occasionally succeed when the canal is very tortuous. The bulb insinuates itself more easily than the rounded end of an ordinary instrument. But where there is much difficulty, and especially when there are false passages, most reliance is to be placed upon a well-curved metal instrument. In any case, the size should be as large as the membranous portion of the urethra will admit without inconvenience.

Catheters should always be thoroughly cleansed both before and after using. The simplest method is to place the end inside the nozzle of a hot water tap and to allow the water to flow through it for several minutes at as high a temperature as can be borne. The only way in which to make certain of asepsis is to keep the catheter immersed in a deep, wide-mouthed bottle filled with some antiseptic fluid. A catheter that is used the last thing at night, or still more, during the night, is certain not to be cleaned at once. No harm can happen if it is placed immediately in a suitable antiseptic, end upwards, so that the air can escape from the interior. Dilute boracic acid lotion or boroglyceride answers for all kinds. Metal and red rubber ones may be kept in a five per cent. solution of carbolic acid, with a drachm of rectified spirit to the ounce. Catheters wear out, it is true, more rapidly when kept in this way (and if there is the least roughness on any part they should be thrown away at once), but when they have to be entrusted to a patient or a nurse it is the only way of ensuring certainty.

The lubricants that are generally recommended are a solution of borax (five per cent.) in glycerine, or Lund's oil (almond oil ℥i., castor oil ℥i., and pure carbolic acid ʒi.). I prefer myself simply vaseline, without an antiseptic. If the catheter is clean it does not require one ; if it is not clean, the momentary application of a dilute antiseptic, one that will not irritate the exceedingly tender mucous membrane of the urethra, is no protection. When the urethra is inflamed and there is a discharge of mucus from the meatus, it is advisable to wash out the penile portion of the canal thoroughly first with a Durham's or Whitehead's syringe, but it is not to be expected that a patient in urgent need of passing urine will adopt this precaution for himself.

The introduction of a catheter for the first time is always a

serious matter, whether it is done to find out the amount of residual urine or for relief in a case of retention.

Whenever it is possible the patient should be carefully prepared. An aperient should be given the night before; the urine should be rendered aseptic by means of salol and boric acid, and especially in the case of those who have suffered from ague or who have lived in the tropics, full doses of quinine should be given the day before and at the time itself. When there is the option, the best time for passing an instrument is in the morning, while the patient is still warm in bed, an hour or two before he need get up. If this is not practicable, the greatest care must be taken that there is no exposure to cold afterwards. One of the serious consequences that not unfrequently follow the passage of catheters is the occurrence of rigors, and these can certainly be precipitated, if not caused, by a chill. The shivering begins as a rule, not when the instrument is withdrawn, but some hours later, after the first act of micturition. All of a sudden the patient is seized with a feeling of prostration and of intense cold, so that the teeth cannot be prevented from chattering. The skin becomes rough and livid. The face is pinched. The eyes are sunken and surrounded by dusky rings. The respiration is hurried and shallow, and the pulse small and frequent. From the first moment, even when the teeth are chattering and the patient shivering, the temperature begins to rise, and it continues through the period of dry burning heat that follows until sometimes it reaches 106° F. As soon as it ceases profuse perspiration sets in, the face becomes flushed, the involuntary muscular fibre in the skin relaxes, and there is a sense of profound relief, although the weakness and exhaustion afterwards are often extreme.

These rigors are thought by some to be due to the absorption of poisonous products from the urine. As, however, they never occur when urine flows over a recent wound, only when it flows down one particular portion of the urethra, there can be no doubt that they originate in the irritation of the nerve fibres distributed there.

Independently of micturition, the least chill applied to the skin after a catheter has been passed will sometimes excite a rigor. I am strongly disposed to believe that in many cases it is not so much the act of micturition that is the cause as the sudden chill, due to getting out of a warm bed without a dressing gown, and

standing, perhaps, with bare feet. I have many times known, after operations upon the urethra, micturition performed with perfect comfort and without any ill consequences for forty-eight hours, and then, at the end of that time, when precautions were relaxed, the next act followed by a rigor. And I have also known rigors caused by the patient getting out of bed and standing with bare feet before an attempt at micturition was made.

A rigor when the kidneys are sound may not be followed by any further ill-consequence. On the other hand, when renal degeneration is present, it not unfrequently indicates the onset of a very insidious and dangerous form of urinary fever. The urine after a day or two becomes turbid and scanty; the specific gravity falls; a certain amount of mucus or a little pus makes its appearance; the temperature rises one or two degrees, and keeps up; there are several slight chills; the tongue becomes dry and brown; the appetite is lost, and there is a tendency to nausea; the mind becomes a little unsettled, and then low muttering delirium begins at night, and the patient sinks into what is called a typhoid state.

The sensitiveness of the urethra may be allayed by injecting half a drachm of a five per cent. solution of cocaine a few minutes before. If the pain is severe, and the patient's kidneys are sound, one-sixth of a grain of morphia may be given hypodermically in the perineum.

The patient should be lying down, well covered up, but with the umbilicus exposed and the thighs slightly flexed and abducted. If he is standing it is more convenient for the operator, but there is a much greater tendency to syncope. When the object is to ascertain the amount of residual urine the patient should empty the bladder, so far as he can, before the catheter is passed. The quantity that may be allowed to escape depends upon the condition of the bladder and the kidneys. In cases of atony, especially when there is much residual urine, and of chronic induration of the kidney (which is in so many cases associated with this) there is a very real danger. Even when the kidneys are sound interference with the deep part of the urethra sometimes has a very serious effect upon the secretion of urine. When they are diseased this is much more likely to happen, and, if it does happen, is much more likely to be lasting. It may take the form either of partial suppression or of polyuria, the difference depending in all probability upon the

degree of congestion of the renal capillaries. It is difficult to say which of the two is the more serious.

This is usually assigned to mechanical causes, the rapid diminution of the pressure, for example, upon the walls of the vessels when the residual urine that has been allowed to collect for months suddenly escapes. It is very doubtful, however, if this is the reason, for the weight of the abdominal viscera, and the tension of the walls would at once prevent it. And the symptoms point to the kidneys, not to the bladder. The cause lies deeper, in the constitution of the central nervous system. Patients with renal disease are peculiarly liable to shock, and the effect of interfering with the residual urine is so great that the vaso-motor nerves of the kidney are paralyzed for the time.

Cases in which the residual urine amounts to thirty and even forty ounces are not uncommon, but it is never advisable to withdraw more than ten at first. If for any reason it must be done, the amount should be made up to the ten ounces, or even to a smaller deficit, by injecting a solution of dilute boracic acid or of boiled salt and water, approximately of the ordinary specific gravity of the urine. In such a case it may be several weeks before it is safe to empty the bladder completely.

After the catheter has been passed micturition should be postponed for as long as possible. The patient should continue to lie down for some hours, warmly covered up. The mucous membrane of the urethra is in a highly sensitive condition, and the longer it is left at rest the better the prospect of its recovery. When the desire is becoming urgent, a cupful of hot tea with three or five grains of quinine and ten minims of the liquor opii sedativus should be given, and the urine should be passed into a convenient receptacle without the patient sitting up or throwing his wraps off. An hour afterwards he may be allowed to get up, but great care must be taken to avoid the least chill, especially at the time of micturition, for at least forty-eight hours. If there is much residual urine, this means that he must keep to his room, if not to his bed, until the bladder has grown accustomed to its new conditions.

The form of urinary fever that is most to be dreaded begins very insidiously on the second or, more frequently, the third day. There has been no rigor or any other alarming symptom, but the expression of the face is changed. The patient looks much older. The eyes are sunken and dusky, and there is a bright, well-defined

flush upon each cheek. The tongue is dry and red. The appetite is gone, and there is a tendency to nausea. The pulse is small and much too rapid. The temperature is only a little raised, but it varies a good deal. Sometimes there are slight chills without amounting to an actual rigor. And the mental state is drowsy, the patient lying in an apathetic condition, occasionally muttering to himself. The urine generally fails in quantity ; when it does not the specific gravity is always low.

Very little, unfortunately, can be done to meet this. The bowels must be kept freely open. A hot linseed meal poultice or half-a-dozen dry cups should be applied to the loins. The skin must be encouraged to act as much as possible, and every precaution taken to keep the urine aseptic. If there is the least odour (and this nearly always precedes in these cases the change of reaction) the bladder must be emptied at once, and washed out with corrosive sublimate. If this does not succeed, or if there is much difficulty in introducing the catheter (the more manipulation of the deep part of the urethra can be avoided the better), a puncture should be made with a trocar and cannula through the perineum, and the bladder drained with one of Annandale's tubes. The diet should be restricted to milk and farinaceous foods, avoiding as far as possible all substances that are likely to increase the amount of urea. Fluids should be given freely. In cases of suppression I have seen decided benefit follow hypodermic injections of digitalin, and pilocarpin has been recommended in the same way.

The frequency with which the catheter has to be passed afterwards depends upon what is found.

(I.) If retention has been complete the catheter must be passed at regular intervals, three, or preferably four, times in the twenty-four hours, according to the capacity of the bladder, until the balance is restored, and the bladder can empty itself again. Meanwhile every endeavour must be made by general and local treatment to diminish the obstruction and increase the power. Recovery may be perfect even after months have passed. Much more frequently some power is regained, but the condition never becomes quite so good as it was before.

(II.) If there has not been complete retention, but a certain amount of residual urine is found, the frequency depends upon the quantity. For three ounces the catheter should be passed once a

day, preferably at bed-time, so as to secure as long a rest as possible; twice for six, and then once more for every additional two ounces.

This must be continued for the rest of life. Such a condition cannot improve; it is more than probable that it will grow steadily and perhaps rapidly worse.

Treated in this way the power of the bladder grows weaker and weaker. The muscles are not used, and waste; the amount of residual urine increases, and the catheter has to be passed at shorter intervals. The treatment relieves the symptoms for the moment, and makes the consequences worse.

Sooner or later the constant passage of an instrument leads to congestion and irritability of the neck of the bladder. Micturition becomes more frequent, and at last it may be almost incessant, so that there is no rest day or night.

Sooner or later, as the gland continues to enlarge, the introduction of the catheter, though at first it may have been perfectly easy, becomes more difficult, until the patient in many cases is unable to use it himself. When congestion supervenes, as it always does, owing to the increased straining and the difficult instrumentation, it may be almost impossible.

Sooner or later the catheter causes cystitis. It is true that some patients appear to enjoy immunity, and that by dint of ceaseless care its occurrence may be retarded in all. But at some time or other it breaks out in almost every case of enlargement of the prostate in which a catheter is habitually used.

Nor, as I have mentioned already, is the beginning of catheter life by any means devoid of risk, even when the kidneys are sound. When they are not, and there is a large amount of residual urine, the danger is a very real one. It may not be the fault of the catheter—to a very large extent the delay in not having used a catheter before is responsible—but the result, so far as the risk to life is concerned, is the same.

It is perfectly true, as Mr. Buckston Browne, among others, has pointed out (Med. Soc., March, 1893), that there are numerous instances all round us of elderly men, active in all the pursuits of ordinary life, and many of them exceptionally highly placed in the conduct of affairs, who are obliged to pass all their urine by catheter, and who lead comfortable, useful, and happy lives.

But there are many others, and I believe a very much larger

number, of whom, from the very nature of things, much less is heard. The successful ones are living, and always in evidence before us, and this alone is apt to lead us unconsciously to overestimate their number.

As Mr. Buckston Browne goes on to show, this state of comfort is dependent in the first place upon there being only a moderate amount of intravesical prostatic growth; and, secondly, upon the amount of attention paid by the patient to his condition. They must, therefore, of necessity belong to those classes which have the knowledge and the means for taking precautions.

Even under these fortunate circumstances there comes a time when the power of personal attention fails; and then, unless they can afford every luxury, and sometimes even when they can, septic cystitis sets in at last.

While I am prepared to agree with Professor White "that in patients with but moderate obstruction, or with a high degree of compensatory hypertrophy of the bladder, with a small amount of residual urine which remains sterile, and in whom catheterism is easy and painless, operation is not to be thought of," I am sure that it is no less essential to bear in mind that the habitual use of catheters is in no respect a cure for the complaint. It only relieves the symptoms, and that not perfectly, and only for a time. It always leads to atony and irritability of the bladder, and nearly always to cystitis. As the disease advances, instruments have to be used more frequently. However easy it is at the first to introduce them, it always becomes more difficult as the need for them grows greater. And though many men lead comfortable and happy lives, it is very doubtful if they are the majority, or even a large proportion, when all classes are taken together. Moreover, the end at last, even in them, is the same.

The comparative comfort so often (but not always) seen at the beginning of catheter life is very apt to throw into the background the much darker picture of what the future will be.

3. *The prevention of irritability of the bladder and cystitis.*

Irritability of the bladder and increased frequency of micturition are among the earliest and most constant symptoms of enlargement of the prostate. The mucous membrane at the neck of the bladder becomes congested. Its sensitiveness is increased, and the

slightest cause excites the desire for micturition. When this is allowed to continue inflammation soon follows.

Passive congestion of the vesico-prostatic plexus is to a great extent natural in old age. The veins enlarge and become varicose; the valves fail to act; the circulation in general becomes more sluggish; the blood finds more difficulty in returning, and the vessels of the pelvic and abdominal viscera are liable to be overloaded. And this is often made a great deal worse by sedentary habits and want of exercise, especially of walking, which has a wonderful effect in quickening the circulation through the pelvis.

In such a condition very little is required to cause an acute attack. A sudden chill; an attack of indigestion; sexual indulgence; constipation, or any irritation about the rectum; an unusual amount of alcohol; a long railway journey, or prolonged retention, and at once the mucous membrane becomes swollen; there is more difficulty in emptying the bladder, and the desire becomes more and more imperative as the difficulty increases.

Irritability of the bladder, without enlargement of the prostate, yields readily to general measures. Local treatment is not only not needed, but is, to a great extent, harmful. Every instrument or foreign substance that comes into contact with the deep part of the urethra is an irritant, and the more they can be avoided the better. The patient should be confined to the house, or his room, or to bed, according to the severity of the attack. The bowels should be kept open; warm baths given night and morning; the diet carefully regulated, especially as regards the amount of alcohol; and especial attention paid to the condition of the urine. Nothing is so irritating, when the neck of the bladder is congested and tender, as an excess of uric acid or oxalate of lime. Even sudden changes in the specific gravity, or reaction, are of consequence. If the irritability is so great as to prevent the patient getting any rest, a morphia suppository may be given at night-time, or a hypodermic injection. I have not found any benefit from either heat or cold in the rectum, while the application of either is nearly always very repugnant to a patient's feelings.

When, however, the prostate is enlarged, general measures, such as these, are very rarely sufficient of themselves. The presence of residual urine and the straining and effort caused by the disadvantage at which the muscular coat of the bladder is placed do

not allow the congestion to subside. A vicious circle is established, the irritability causing increased frequency, and the increased frequency making the congestion and irritability worse. All instruments are injurious, but local measures must be employed to give the bladder a fair chance of rest and recovery.

A slight degree of irritability can be relieved by passing full-sized steel sounds and leaving them for half-an-hour or more. The superficial vessels are emptied by their pressure, and though they fill again as soon as the sound is withdrawn, it is of some advantage to have enabled their walls to contract, if only for a time. The dilatation has also a very considerable effect upon the muscular fibres that surround the lower part of the bladder and the prostatic urethra. They are made to tire themselves out and relax. After all sources of irritation have been removed these fibres often maintain a state of spasm which perpetuates itself by the congestion that it causes and the pressure it exerts upon the swollen and tender mucous membrane. In some cases they become hypertrophied, so that at last an actual sphincter is developed. Sedatives and astringents are of no avail. Dilatation, on the other hand, soon gives relief. The benefit that has been derived from digital exploration of the bladder is in many instances due to this as much as to the drainage that has followed it. The fibres around the neck have been paralyzed for a while, the blood vessels and nerve endings have been allowed to rest, and by the time the muscles have regained their tone the symptoms have subsided.

If this does not avail and the irritability persists, and especially if the amount of mucus in the urine begins to increase, or the odour becomes offensive, the bladder and the prostatic portion of the urethra must be washed out regularly and systematically.

The simplest apparatus is a glass funnel, with a long piece of rubber tubing, and a catheter provided with a terminal opening. The catheter should be made with a side branch shut off by means of a stop-cock, and this should be so arranged that while the fluid can pass down from the tubing into the bladder it will not pass back again, but flow out from the bladder through the side branch.

The residual urine is drawn off first, the apparatus filled, and to prevent cooling immersed in the fluid at the desired temperature. The catheter is then passed down, just through the membranous part, the stop-cock turned, and the funnel raised as high as neces-

sary. A few inches pressure is usually enough. Then the stop-cock is reversed, and the fluid allowed to escape through the side branch, so that the same does not enter again. As a rule the quantity should not exceed four or six ounces. Finally the catheter is pushed into the bladder, and the cavity emptied.

Hydrostatic pressure for washing out the bladder has many advantages over a syringe. It can be graduated to a nicety, and is perfectly steady. The patient can regulate it himself, directing the stream according to his own sensations, and stopping it when it begins to cause the least discomfort. And the quantity that is injected can be easily checked against that which flows out. This is necessary, not only because of sacculi, but because sometimes there is a valvular growth hanging over the orifice, so that fluid can enter readily without being able to return.

In many patients the bladder can be washed out without passing a catheter beyond the fossa navicularis. The resistance of the sphincter is overcome by gradually increasing the pressure. This is not advisable in cases of enlargement of the prostate, unless it is wished to exercise the muscular power of the detrusor urinæ. The end of the catheter should be passed through the sphincter at the apex of the gland, so that the fluid can return without throwing any work upon the muscular coat.

Belfield (*loc. cit.*) recommends that when the bladder is to be washed out thoroughly the patient should be placed in the knee and elbow position, or that suction by means of a syphon should be employed. This, however, is only necessary when there is a great accumulation of mucus in the post-prostatic pouch, or when the interior of the bladder is very irregular in shape. Very great care is required when there is any reason to suspect the presence of sacculi. Their walls are often exceedingly thin; fluid enters easily, but there is no force to drive it out again.

A great variety of solutions have been recommended at different times for washing out the bladder. When the reaction of the urine is normal, and the amount of mucus is not much increased, dilute salt solution (made with boiled water) is the most useful. It is aseptic itself, and it irritates the tender surface less than anything else. If there is much catarrh, boroglyceride (a teaspoonful to the pint) may be employed, or borax (a drachm to the pint), iodoform (gr. v. ad. ℥i, suspended in mucilage), or salicylic acid (one per

cent. solution). Acetate of lead (gr. i ad. ʒiv) and nitrate of silver (gr. i ad. ʒiv) are most useful in chronic cases in which there is much muco-purulent discharge; and the latter of the two is especially recommended when from the persistent bleeding there is reason to suspect the presence of superficial ulceration.

More powerful antiseptics are required if the urine begins to show signs of decomposition. The one that has answered best in my hands is corrosive sublimate, one part in two thousand, gradually reduced as the offensive odour disappears to one in ten thousand. Quinine, a grain to the ounce, with one or two drops of dilute nitro-hydrochloric acid, may be employed when there is a tendency to phosphatic deposit. Carbolic acid, of sufficient strength to correct septic decomposition, is too irritating; but this is said not to apply in the case of izal. Belfield speaks very highly of iodine trichloride, one part in two thousand.

Iodoform answers best when it is wished to leave a small quantity of an antiseptic behind in the bladder, as it is more concentrated. But quinine and even corrosive sublimate may be employed in this way if it is thought that the action of iodoform is not sufficiently energetic.

Many cases of enlargement of the prostate suffer at one time or another from a constant burning pain at the neck of the bladder, shooting down to the end of the penis, and attended by the most persistent spasm. This can generally be relieved by injecting a few drops of a solution of nitrate of silver, five grains to the ounce. There is usually in cases of this kind either widely spread abrasion of the epithelium at the neck of the bladder, leaving an intensely irritable surface exposed, or some fissure or small ulcer concealed between the folds of the mucous membrane at the orifice. The nitrate of silver acts by coating the surface over with an insoluble protective layer, and giving it rest for a while. The chief difficulty, especially when there is merely a fissure, is to apply it accurately. The only method is by injection, and then, as the bladder is rigidly contracted, the fluid often fails to reach the surface of the sore.

Cocaine may be used for this purpose, but its effect is very transient. It often causes bleeding, and, owing to the vascular paralysis that follows, it sometimes makes the congestion worse. Morphia introduced into the bladder is of very little use. Probably it is too soon diluted, as it gives great relief when introduced as a suppository in the neighbouring bowel.

Unless there is an intra-vesical prostatic upgrowth, measures of this kind, combined with the general treatment that has been detailed already, usually relieve the irritability; the frequency of micturition diminishes; the pain and spasm at the neck subside; and the bladder, to all appearance, regains its former condition. Leaving aside, however, the question of intra-vesical growths (which alters everything, for the irritability they cause can only be removed by operation), relapse sooner or later is certain.

The symptoms are relieved, it is true, but the causes are left. They have not been touched. On the contrary, they are able to work at greater advantage. The amount of residual urine is larger than it was before, the catheter has to be introduced more frequently, the mucous membrane is more sensitive, and the condition of the tissues is distinctly changed for the worse. In youth an attack of irritability of the bladder may pass off and leave no ill-effect behind. It is different when the prostate is enlarged. The blood vessels do not recover their tone so readily, the tendency to congestion is greater, the nutrition of the muscular coat is not so good, and the fibres never regain the whole of their former power. The amount of residual urine is always greater after one of these attacks.

The more frequently the bladder is attacked the more susceptible it becomes. The intervals grow shorter and shorter; the irritability never wholly subsides; the catheter has to be passed more and more often, and at last the patient's condition becomes one of intense misery. The catheter is required every hour. The urgency is such that the patient cannot endure a moment's delay. The introduction becomes more and more difficult, and the pain, when at last the instrument does pass, is scarcely less than that which comes on as soon as it is withdrawn.

As a rule, long before matters have reached this point, inflammation breaks out, and becomes septic. Then the downward progress becomes more rapid still. The urine becomes loaded with mucus or mucopus, which collects in the lowest part of the bladder, and is either the last to come out, or never comes out at all. The pain is much more severe and continuous. There is tenderness on pressure over the pubes, and an aching sensation, or if the attack is acute, throbbing in the perineum, spreading round the loins and down the thighs. Micturition is incessant. Every attempt is followed by blood, as the muscles around the neck of the bladder

contract and squeeze the swollen and congested mucous membrane. The patient is hot and feverish; his tongue is dry; the appetite is lost; rest at night is hopeless; and he is absolutely worn out by the intense burning pain that forces him to try to pass water or to introduce a catheter every minute, and grows worse and worse with every attempt.

CHAPTER IX.

THE LOCAL TREATMENT OF ENLARGEMENT OF THE PROSTATE—ITS COMPLICATIONS—CYSTITIS—RETENTION—HÆMATURIA AND CALCULUS.

THE outbreak of cystitis marks a distinct stage in the course of enlargement of the prostate.

It means that the protection of the mucous membrane no longer exists. So long as this is healthy and uninjured it is an effectual barrier against infection. Guyon has shown that the bacterium pyogenes (which is almost certainly the main agent in these cases) may enter the bladder freely without being able to inflict the least injury upon it so long as the mucous membrane is healthy. If, however, it becomes congested, and still more if it becomes inflamed, the barrier is broken down, and when pathogenic organisms find their way in, septic cystitis and decomposition of the urine are certain to follow.

The mode in which these organisms gain entrance does not admit of doubt. They can pass into the urine through the kidneys. It has been proved of many micro-organisms that they are excreted in this way, at least in part, and they have been cultivated from the urine. But it is very improbable that this is the ordinary route. In the vast majority of cases they are introduced directly by means of catheters. The frequency with which septic cystitis occurs is proportionate to the frequency with which catheters are used. In the very few cases in which it breaks out independently of catheterization, the infection does not occur through the kidneys, but by direct extension along the mucous membrane of the urethra, the surface of which is coated over with a thick layer of alkaline mucus. Infection, in other words, is always of local origin, and is nearly always caused by the very means that are employed to keep its consequences in check.

If everything were ideally perfect this complication would not occur. It ought not to occur, and by taking the greatest precautions it can, in most instances, be prevented, or, at least, postponed. But when a catheter has to be passed every day, and often several times a day, and that for years together, over a mucous

surface that is exceedingly sensitive, and in many instances becomes more sensitive every time it is touched, it is not in human nature to maintain a sufficient degree of care. Septic cystitis, sooner or later, is the rule.

The local treatment of septic cystitis must be guided by the extent of the pathological changes in the bladder and prostate. The principle is always the same. The residual urine that lies in general almost inert in the lowest part of the cavity has been transformed into a virulent poison which the bladder cannot expel. Decomposition must be arrested, and the bladder freed from the irritant that is destroying it.

1. If the cystitis is recent, and the amount of residual urine small, so that the walls of the bladder are not as yet seriously injured, if the patient's strength is well maintained and a catheter can be passed without difficulty, this can be accomplished by washing out the cavity through the urethra, as described already.

The patient must be confined to bed, warm hip-baths given night and morning, the bowels kept open, and the diet carefully regulated. Alcohol is not good for cystitis, but the patient may require it. Digestion is rarely very active ; sleep is always much disturbed ; the pain is intense and incessant ; and the action of the heart often feeble and inclined to intermit. The affection has ceased to be a local one. Septic intoxication, due to absorption through the vesical wall, has been added to the other troubles.

Salol, boric acid, quinine, and benzoate of ammonia are the most efficient internal remedies, but the condition of the patient must not be lost sight of in attending to the state of the urine. More good may be done sometimes by small doses of alkalies with stomachics and mild tonics.

Sedatives are nearly always required. The best is opium, either by the mouth or the rectum, if, that is to say, the condition of the kidneys will allow it. It is the only drug that can be relied upon to relieve strangury and save the patient's strength. The liquor opii sedativus is the preparation I always prefer. If this is not well borne, nepenthe may be given, or morphia hypodermically. And if these are not satisfactory, or are contra-indicated by the state of the kidneys, recourse must be had to chloral and bromide ; but though these procure sleep, they do not give the same relief. The same may be said of sulphonal, which often answers for a time. It must, however, be given early in the afternoon, and the patient

sometimes complains of the drowsiness it leaves after its immediate effects have passed off. Sometimes when nothing is very satisfactory a mixture of small quantities of many hypnotics, opium, chloral, bromide, and cannabis indica succeeds.

I have not found any antiseptic so efficacious in washing out the bladder in these cases as corrosive sublimate, beginning with one part in two thousand and lowering the proportion as the decomposition is checked. It should be used three or four or even more times a day, according to the severity of the attack, and a small quantity, an ounce or two, should be left in the place of the residual urine. Care must be taken to wash out and disinfect the prostatic urethra as well.

Provided the cystitis is recent, the condition of the wall of the bladder in other respects good, and the introduction of a catheter easy, septic cystitis can generally be checked and brought under control by adopting sufficiently energetic measures of this kind. The patient is restored to a state of comparative comfort, but he will have to use a catheter more frequently than he did before; and as the same causes continue to work, and to work from a point of greater advantage than they did, he will be exposed to the old risks in an even greater degree. The consequences have been averted; the causes have not been removed; recurrence is only a matter of time, and each time the intervals grow shorter and the symptoms more severe.

2. It seldom happens, however, when septic cystitis occurs in a case of enlargement of the prostate that the conditions are so simple and straightforward; and if they are at the first they never remain so for long. The patient is usually suffering from incipient uræmia and septic intoxication, and is broken down in health and strength from pain and want of rest. The bladder is almost always in a hopeless state, ulcerated, coated over with a foul smelling mixture of phosphates, pus, and decomposing urine, and most irregular in shape. A catheter is required every hour or even every half-hour. The prostate has grown to such an extent, or has become so swollen from congestion, that it is difficult for the surgeon and impossible for the patient to pass one. And every attempt is attended with hæmorrhage and agonizing pain. Catheterism under such conditions has been aptly described as a slow but fatal form of torture.

The indications are the same. The bladder must be emptied

and septic decomposition stopped. But this cannot now be done by catheter. The time has passed for this. Some other method of draining the bladder must be adopted, through the prostatic urethra, through the prostate itself, or over the pubes through the anterior wall.

The method must be one that is capable of being made permanent. Relapse, when once the bladder and prostate have reached this stage, is practically certain. If radical measures are not sanctioned, or if it is too late for them, it is better for the patient to maintain a permanent system of artificial drainage than to allow the opening to close after the immediate effect has been obtained, and resort to the use of the catheter again. If septic cystitis was not prevented before it will not be now. The liability increases with each attack.

Sir H. Thompson recommends a perineal incision as "on the whole more useful and more generally available in most of the instances in which efficient surgical relief is demanded."

"I employ the central incision, using a median grooved staff and a long, straight, narrow-bladed knife, with the back blunt to the point. Having placed the left index finger in the rectum, the knife may be introduced, edge upwards, about three-quarters of an inch above the anus, with or without a small preliminary incision of the skin (I prefer the former) until the point reaches the staff about the apex of the prostate gland, where it divides the urethra for half-an-inch or so, and is then drawn out, cutting upwards a little in the act, but so as to avoid any material division of the bulb. The left index finger is now removed from the rectum, simply wiped upon a napkin, and, following the groove of the staff, slowly passed through the neck of the bladder as the staff is withdrawn. The interior of the bladder should first be explored; when this is completed a large vulcanised india-rubber catheter, say, about No. 18 or 20 (English scale), or a tube should be introduced with its extremity just within the bladder. Here it should be retained a few days, according to circumstances, chiefly those which regard the relief and comfort of the patient" ("Diseases of the Prostate," sixth ed., p. 178).

Annandale ("Edinburgh Med. Journal," Vol. xxxiii.) makes use of the same method as a permanency. "An india-rubber catheter of full size having been cut short so that its rounded end will lie in the bladder and its cut extremity project half-an-inch

from the perineal wound, has fitted into the projecting end a short tube of hard vulcanite half-an-inch in length. This allows a silk or other thread, with two short loops, to be firmly fastened round the catheter without interfering with its canal, and by means of these loops the catheter is secured in position in the ordinary way. To the other end of the vulcanite tube any convenient length of rubber tubing can be fixed, and by placing a small stop-cock on the tubing the bladder can be readily emptied at any time."

Harrison (*loc. cit.*) is in favour of tapping the post-prostatic pouch directly through the substance of the prostate. The patient is placed in the lithotomy position and the left forefinger introduced into the rectum to act as a guide. A straight trocar and cannula is then pushed through the middle line of the perineum, three-quarters of an inch in front of the anus, through the enlarged median portion of the prostate, straight into the bladder. The trocar is withdrawn and the cannula secured with tapes in the ordinary fashion.

In the course of a week or ten days the patient may be allowed to get up, with a rubber tube fastened on to the cannula. The other end of the tube can be either secured by a clip or led off into a portable urinal. There is little or no leakage around the puncture. After some weeks the urine begins to find its way down the urethra, and this may be regarded as a signal for withdrawing the drain.

Whitehead ("Proc. Med. Society," Vol. xii.) recommends a permanent perineal opening for cases "that have reached the stage when all prospect of their ever again being able to pass urine in the natural manner has to be abandoned as hopeless. A staff is passed into a previously moderately distended bladder. A lithotomy knife, with its edge upwards, is plunged directly into the groove of the staff from a point an inch above the anus to a point a little in front of the prostatic apex. I prefer to enlarge the skin incision as I withdraw the knife, leaving the external wound when finished about an inch in length, and directed from the raphe towards the centre of the space between the anus and the left tuber ischii. As the staff is withdrawn the finger is passed into the bladder when possible, and the opportunity is taken of making a digital exploration. When nothing is discovered admitting of immediate operation the tube is introduced and maintained by a T bandage, which I have found quite as effectual and much more comfortable to the

patient than tapes. My preference for enlarging the external wound by one sweep of the knife, during its withdrawal, in the place of cutting down upon the staff by repeated incisions, is to secure a clean section, and thus to avoid an irregular wound, which gives greater facilities for the lodgment of discharges. The limited space between the point where the knife first enters the urethra and the rectum does not afford sufficient room for a wound which is required to remain permanent, unless the incision be made obliquely in the manner described. The original opening in the skin should be made large enough at first, as it will then last for years without the necessity of dilating. But if made too small it may require enlargement within a few weeks of the operation. It is the cicatricial contraction of the skin, and not of the deeper parts, which gives rise to this trouble."

The fistula established in this fashion can be utilized at pleasure for the dual purpose of removing the contents of the bladder and of minimizing the inconveniences attending systematic irrigation. An instrument need not be constantly worn. There is no incontinence; the urine can be held for four or five hours, or it can be drawn off with a short tube when necessary. The bladder can be washed out more thoroughly. A larger catheter and a fuller stream can be used. At each washing six inches of the most sensitive part of the urethra escape the irritation produced by a catheter, and relapse of the cystitis is avoided by maintaining the opening permanently.

Supra-pubic tapping with a trocar and cannula, which answers so well for retention or impermeable stricture, is not advisable for drainage when the prostate is enlarged. The bladder in many cases is small and contracted. The peritoneal fold may descend as low as the pubic symphysis. A cannula is often not well borne when there is an intra-vesical growth, and without a cannula sufficiently long to dip down into it, it is not easy to drain a large and deep post-prostatic pouch. If supra-pubic tapping is thought advisable for any reason, it is better to use the instrument devised by Sir H. Thompson for raising the wall of the bladder and introducing a drainage tube than to trust to a trocar and cannula as in tapping for retention.

Supra-pubic cystotomy, on the other hand, which was first performed by Sir H. Thompson for this purpose in 1869, is of excellent service. The only exception is when the bladder is very much

contracted with rigid unyielding walls. The interior can be explored; pouches, if any are present, can be drained, and calculi removed. There is no doubt that calculi are more common in septic cystitis consequent on prostatic enlargement than is usually believed. They lie in the post-prostatic pouch, and as they never come into contact with the orifice do not cause the ordinary symptoms; but they prevent the cystitis getting well. It is no use attempting to cure inflammation if a calculus is left behind. Further, the condition of the intra-vesical portion of the prostatic growth can be accurately determined and valuable information gained about the urethral portion and the influence it has upon the orifice.

The operation is performed with the usual precautions. The day before the skin over the pubes is shaved, thoroughly well scrubbed with soap and water, and covered with a carbolic compress. The bladder is emptied and well washed out with a warm solution of boracic acid (half an ounce to the pint) before beginning the operation. It is probably hopeless trying to disinfect the walls in a case of advanced cystitis, but care should be taken that the contents are as aseptic as possible. Sufficient is left in to fill the bladder to moderation. As a rule eight ounces are enough, but if the size is small, or if there is any reason to suspect the presence of sacculi, this must be reduced by one-half. Distension of the rectum I have almost abandoned. It tends, it is true, to raise and fix the floor of the bladder, but where the question is merely one of drainage this is unnecessary, and it is not altogether devoid of danger.

Trendelenburg's position may be adopted with advantage if the patient's respiration is good, but great care is required in old men with rigid chests and emphysematous lungs.

The incision should be in the middle line, from $2\frac{1}{2}$ to 3 inches in length, commencing over the symphysis. Trendelenburg's transverse division has nothing to recommend it, and is followed more frequently by weakness of the wall. The tendinous structures are divided freely down to the transversalis fascia. As soon as this has been opened the finger is introduced and the sub-peritoneal fat and peritoneum carefully lifted off the bladder wall and hooked upwards with the finger nail. If the bladder is tense and prominent it may be punctured at once with a scalpel, and the finger introduced behind it to hook up the wall and examine the interior.

If, on the other hand, it is deeply situated a tenaculum should be fixed in it to hold it more firmly. The incision should be in the median line on the most prominent part of the bladder below the peritoneal fold, between the veins that lie upon its anterior wall, and long enough to admit the forefinger without much difficulty.

If there is nothing that requires removal there is no need to insert any sutures in the bladder wall. A soft rubber drainage tube of full size should be introduced well into the cavity and fixed there, either by means of a suture passed through the skin, or preferably by a plate that slides up and down upon it, and can be secured by strapping. The other end can be conducted to a vessel under the bed. The upper part of the incision is then drawn together by sutures and soft absorbent dressings applied. In this way the patient can be kept perfectly dry, the bladder washed out as often as required, either through the urethra or through the tube, and at the end of three days, when the soft tissues around the wound have become consolidated, the tube can be removed and replaced or not according to the condition of the bladder.

If, however, anything is found in the bladder likely to require manipulation, if, for example, the mucous membrane is coated over with such dense phosphatic concretions that it is thought advisable to remove them and not leave the surface to throw them off quietly by itself, it is as well to pass two silk sutures through the muscular wall of the bladder, one on each side, to hold it up and prevent any strain falling upon the soft cellular tissue around it. Afterwards they can be withdrawn.

I have never found any difficulty in draining the bladder through a supra-pubic opening, even when the patient was lying on his back in bed. The pressure of the abdominal viscera is sufficient to prevent the formation of any cavity in which fluid can collect. A tube is necessary for the first few days, until the soft tissues have become glued together by lymph, and afterwards if it is wished to keep the artificial channel open; the bladder remains empty the whole time.

Many attempts have been made to utilize a supra-pubic channel obtained in this way as a permanent urethra, under the control of the patient, so as to do away for ever with the necessity for passing a catheter.

The simplest is the apparatus devised by Mr. Buckston Browne ("Brit. Med. Journal," Aug., 1888). A soft rubber catheter is

held in the sinus by means of a silver plate, which is kept in position with a belt and a perineal band. The other end of the catheter is conducted by means of a rubber tube to a portable urinal strapped on to the patient's leg. "The usual clothes are worn, and the patient can walk and drive with ease."

In a few cases a vulcanite and rubber tube, provided with a stop-cock, has been used without any apparatus to collect the urine. Every three or four hours the patient obtains relief by turning the stop-cock and allowing the retained urine to escape under the abdominal pressure. There is very little leakage around the tube, and this might be prevented entirely by adopting Wiley Broome's suggestion and cutting a screw thread on its outer surface.

Hunter McGuire ("Trans. Amer. Surg. Ass., 1890") recommends opening the bladder at the lowest available median point, and leaving open the upper end of the abdominal wound, the rest of the abdominal incision being sutured. This leaves a fistula two or three inches in length, the walls of which are kept in apposition by the pressure of the viscera, so that the patient can retain his urine or pass it at will. Dr. McGuire has written to me since then, that he does not attach the bladder to the abdominal wall in any way because this interferes with the length of the artificial urethra. "I find it necessary to keep a plug of aluminium or of some other metal in the sinus, the patient taking it out only when he wants to pass water."

The artificial urethra in this operation is surrounded by cicatricial tissue, and is liable to contract. With the view of preventing this Morris ("New York Med. Journal," July, 1890) has tried to line the channel with skin flaps. "A ribbon of skin and subcutaneous tissue about three inches long and one-third of an inch broad is dissected away from either side of the abdominal incision, leaving the caudal extremities of the ribbon attached. The free ends of the ribbons are now sutured with fine catgut to the mucous membrane of the bladder, each on its respective side. The temporary sutures which held the bladder up are now cut, and as the bladder drops down it takes with it the two ribbons of skin, which lie prettily face to face, and which are to form a soft urethra of skin. A short rubber drainage tube is left in the bladder for forty-eight hours. Four weeks after the operation the ribbons of skin form a soft round urethra. The patient can retain his urine or pass it at will, and he substitutes a glass drainage tube for the

penis, pressing one end of the tube against the supra-pubic meatus and passing urine through it. In order to do this he makes an ordinary expulsive effort and no urine comes by way of the penis." Dr. Morris has written to me since that the sinus became rather too small from contraction of the walls, and that in another case he would make the flaps wider.

In one case under my care I tried this method with this alteration, that I left the ribbons attached by their upper ends, in order that I might secure at the same time the advantage of Hunter McGuire's long valvular urethra. The urethra answered very well for a time, but an angle developed in it, where the cutaneous flaps joined the mucous ones. The superficial portion of the sinus ran upwards towards the head; the deep part, backwards, towards the sacrum, and some phosphatic material collected at the bend. Later a perineal abscess formed (the original operation was performed for sloughing of the urethra consequent upon exceedingly severe extravasation of urine), and when this was opened the urine came through it, so that the supra-pubic channel was no longer used, and was allowed to close. The skin flaps marked its external opening merely as a small dimple. Had a plug or a tube with a stop-cock been worn in it at night time I believe it would have remained straight and free, and would have answered admirably. (See paper by author, "Lancet," June 23, 1894.)

The choice of method depends to a great extent upon the condition of the patient. Supra-pubic cystotomy is by far the most complete operation, enabling the interior of the bladder to be examined thoroughly, so that calculi, etc., can be removed; and the result even if Morris and McGuire's modifications are not adopted is as satisfactory as that which can be obtained by any other route. But it only too often happens that by the time operation is agreed to, the patient is already at death's door, in a state of incipient uræmia, worn out by the want of sleep and the torture of hourly catheterism, and poisoned by septic absorption from the bladder. Only the least possible can be done. The choice lies between external urethrotomy with one of Annandale's tubes adjusted to the prostatic urethra, and Harrison's method of puncture through the perineum; and the decision must be guided by what is known of the size of the prostate and the depth of the post-prostatic pouch.

RETENTION.

Retention of urine is one of the most common complications of enlargement of the prostate. Sometimes it occurs suddenly, without warning, and is the first intimation the patient receives that there is anything wrong. More often there has been gradually increasing difficulty for months or years before. In either case no drop of urine can pass; the bladder becomes distended more and more; there is the most intense pain in the lower part of the abdomen; and unless speedy relief is given symptoms of a typhoid character quickly supervene.

This condition must be distinguished from the simple accumulation of residual urine. In the one the orifice of the bladder is closed, and no power that the muscular coat possesses is of the least avail. In the other the orifice is free, more or less, and the cavity full because the muscular fibres are unable to expel the contents.

Retention may occur in every stage of enlargement. The immediate cause is nearly always an attack of congestion. The route may be perfectly free under ordinary circumstances, or it may be half-closed by a valve hanging over the orifice, or by the growth of the prostate around it. Suddenly congestion sets in; the mucous membrane becomes enormously thickened and swollen, and the size of the valve is increased, or the width of the passage is narrowed to such an extent that no urine can flow down. The more the patient strains the worse the congestion becomes, and at last the mucous membrane is engorged with blood to such an extent that it is as hard and rigid as the prostate that lies around it, and the sides of the urethra fit into each other as closely as if they were dovetailed together.

Sometimes this congestion is inflammatory, caused by injury, the passage of catheters, for example, or the impaction of a calculus. More often it is passive, arising from a sudden chill, exposure to cold or wet, or alcoholic or other excess.

In some of these cases the bladder attains an enormous size, reaching nearly to the umbilicus, holding three or four pints of fluid, and causing a distinct and characteristic projection of the lower part of the abdomen, even when the patient is lying on his back in bed. In others, however, and these are often the worst,

there is resonance over the pubes. The bladder is so small and its walls so thick and hard that it cannot stretch or hold more than a few ounces.

Immediate relief is imperative. Retention, in a case of enlarged prostate, for however short a time, never occurs without leaving some serious result behind. Atony from over-stretching of the muscular fibres is invariable, and may be complete and permanent. More commonly it is only partial; but when it occurs in an old man suffering from a complaint of this kind it rarely passes away entirely. Urinary fever always follows. The function of the kidneys is seriously interfered with from the greatly increased pressure in the urinary passages. Hæmaturia is exceedingly common, independently of the passage of instruments. The distended and often varicose veins around the neck of the bladder give way, and their contents pour into the walls and into the cavity through rents in the mucous membrane. Cystitis frequently sets in, partly perhaps from the means taken to procure relief, but partly also because of the injury that has been inflicted upon the mucous membrane. And sometimes the consequences are graver still; suppression and uræmia may follow.

A catheter must be passed at once, without more delay in the preparation of the patient than is absolutely necessary. If this does not succeed the bladder must be tapped.

Retention of urine in a case of stricture of the urethra can nearly always be relieved by placing the patient in a hot bath for a quarter of an hour or twenty minutes, giving him a full dose of opium and getting the bowels to act freely. The urine may not come in a stream, but it will come sufficiently fast and in sufficient quantity to relieve the urgency. When retention is due to enlargement of the prostate this is rarely advisable.

For one thing time is too precious. The bladder, in a case of stricture, has nearly always had difficulty for a long time past, and a few drops of urine usually manage to escape, often continuously. Retention due to enlarged prostate (not, of course, the mere accumulation of residual urine) is complete and urgent. The congestion, too, which is nearly always the immediate cause, is passive. Unlike the inflammatory hyperæmia that sets in around a stricture that has been irritated, it is but little relieved by warmth, and may be made worse. Opium again, unless the condition of the patient's kidneys is known beforehand, cannot be given, for the dose, to be of

any immediate benefit, should be a full one. The wall of the bladder is weaker and much nearer atony, and the patient is not a young man.

It is best for the patient to lie down. A black coudé catheter, No. 9 or 10 English, is the most suitable to begin with. If this does not answer a gum elastic with a stilet or a metal one should be tried. The point of the instrument in either case can be tilted so as to rise over any obstruction upon the floor of the urethra; but the former has the advantage that the curve can be altered by withdrawing the stilet a little, as originally recommended by Hey.

Metal instruments should be provided with a prolongation curved in the reverse direction to fit into the handle, so as to avoid spirting of the urine over the bed clothes. In the case of a black one, a piece of ordinary rubber tubing may be attached for the same purpose, but this is, of course, impracticable with gum elastic catheters when a stilet is used.

If the condition of the patient's bladder as regards the amount of residual urine was unknown beforehand, and the quantity present is large, over a pint and a half, it is better not to draw the whole off at once, and after an ounce or two has escaped to reduce the size of the stream. Retention in enlargement of the prostate is always followed by urinary fever, and though one factor in the production of this may be the irritation due to the catheter, another and a more important one is the congestion of the already indurated kidneys caused by the obstruction, and made a great deal worse by the sudden shock of evacuation.

Whether the catheter should be tied in or not depends upon the difficulty there has been in introducing it, and upon the state of the urine. If this is foul and septic the more quickly the bladder is drained the better. It may be taken for granted that, unless the attack is a very recent one, the catheter will be required again in the course of an hour or two, not because of the amount of urine, but because of the irritability of the neck of the bladder. The mucous membrane in these cases is so engorged with blood and so hard that it is often many days before the swelling undergoes any appreciable diminution, and the muscular coat of the bladder recovers. During all this time a catheter must be passed at frequent intervals; and accordingly, even when there is but little difficulty in its introduction, it is usually better to tie it in, at least, for the first twenty-four hours.

In securing a catheter in the bladder it is sufficient if the point lies just inside the neck. The other end may either be plugged, or, if the urine is foul and septic and it is wished to drain the cavity, connected by means of a long piece of rubber tubing with a vessel containing some disinfectant under the bed. The quantity passed in the twenty-four hours and the specific gravity should be carefully noted for several days.

The patient should be kept in bed and the temperature of the room well maintained. I have several times known rigors follow slight exposure. The diet should be light and easily digested, not containing too much nitrogenous material, and the bowels kept relaxed. Warm hip-baths, night and morning, conduce to comfort and cleanliness, but the duration should be very short. The question of alcohol must be determined by the condition of the pulse and a knowledge of the patient's previous habits. The exhaustion from pain and prolonged want of rest is usually so great that it can scarcely be dispensed with.

I have known great benefit follow dry-cupping over the loins and the subcutaneous injection of digitalin (one-fiftieth of a grain) in several cases in which the secretion of urine was very scanty, and in one in which it was almost suspended for twenty-four hours.

If a catheter cannot be passed an opening must be made in the bladder.

The choice lies between the supra-pubic and the perineal routes. Rectal tapping through the prostate (for in these cases it is neither easy nor safe to go above it) does not present any advantage over other methods, and cannot be used for drainage should this be thought desirable.

The size of the bladder is a material point. If it is small and contracted with hard rigid walls, the suprapubic route is inadmissible, and puncture through the prostate and perineum, after Harrison's method, is to be preferred.

Aspiration supra pubes is only to be recommended when it is wished to gain time, to give the patient temporary relief while preparation is being made for more permanent measures. Retention in a case of enlarged prostate is nearly always due to congestion; the mucous membrane lining the neck of the bladder and the prostatic urethra is engorged with blood to such an extent that it becomes perfectly hard. If this is sufficient to prevent a catheter

passing it will not subside for many days to come, and aspiration would, therefore, have to be repeated several times a day for a week or more. It is true that this has been done with perfect safety. I have known a bladder aspirated seventeen times without any ill result. But I have also known suppuration take place in the pre-vesical tissues after the third aspiration, and there can be no question that the risk increases with the repetition. After puncture with an aspirating needle the bladder empties itself through the cannula, and the mucous membrane, as it collapses, alters its relation to the muscular coat, so that when the instrument is withdrawn the opening becomes valvular. Many perforations, however, lead to softening and inflammation of the wall, and at last to leakage. It is impossible to vary the site very much.

In aspiration a puncture is made with a tenotomy knife through the skin immediately above the upper border of the pubes in the middle line. In stout people there is usually a fold here which may be taken advantage of. The trocar and cannula are then pushed through the subcutaneous tissues and driven smartly downwards and backwards (in the recumbent position of the patient), without following too closely the posterior surface of the pubes. To prevent any of the contents escaping as the cannula is withdrawn, a few drops of some antiseptic solution should be sent through it when the urine ceases to flow, and care should be taken to keep the finger pressed firmly upon the orifice. The last few drops of urine are often thick and turbid, and a string of mucus may cling to the lower opening of the cannula and fall off as it is being drawn out through the wall. No anæsthetic is required.

Supra-pubic tapping with a trocar and cannula, supra-pubic cystotomy and perineal tapping after Harrison's method have been described in connection with drainage of the bladder. If the relief of retention is the only object in view, I cannot see that either of the two others possesses any advantage over supra-pubic tapping. On the other hand, there are objections to puncturing a swollen prostate, surrounded by immensely distended venous plexuses (though I am bound to admit that I have done it on a good many occasions without meeting with any ill result), and cystotomy is an unnecessarily severe proceeding unless it is wished to explore the interior of the bladder for calculi, phosphatic crusts, intravesical prostatic growths, and the like, or to drain it afterwards.

HÆMATURIA.

Hæmaturia is of common occurrence in enlargement of the prostate. The amount of blood lost is seldom important, a drop or two at the utmost. It is only on rare occasions that it is sufficient to distend the bladder or cause any anxiety. The mucous membrane that lines the neck of the bladder and the prostatic portion of the urethra is always in a state of congestion, and the passage of an instrument or the mere contraction of the muscular coat is sufficient without presupposing any degree of violence. Nearly always the blood comes with the last few drops or after the instrument is withdrawn. Exceptionally, when one of the varicose veins that are so common under the mucous membrane at the neck of the bladder gives way, the quantity may be more considerable and the blood may be mixed with the urine.

Soft adenomatous outgrowths at the neck of the bladder or in the prostatic portion of the urethra not unfrequently bleed freely and persistently.

Prostatic retention is nearly always attended by hæmorrhage. The congestion is so great that the thin-walled veins give way, and the mucous and submucous layers are filled with extravasated blood, or the sudden relief of pressure when the urine escapes leads to the same result. The amount is rarely serious, considered from the point of view of the loss of blood, although it is not uncommonly sufficient to lead to the formation of coagula in the bladder. A few cases are on record in which the hæmorrhage has been very considerable, distending the bladder to its utmost size, causing the most intense pain, and leading to suppression.

Hæmorrhage from an enlarged prostate seldom requires local treatment. Nearly always as the fluid collects, the pressure closes the openings through which the blood escapes, so that they become sealed.

Pain should be relieved by opium, which has the additional advantage of keeping the patient quiet and preventing to some extent the violent spasmodic contraction of the bladder. The best hæmostatic is chloride of calcium (Wright, "Brit. Med. Journal," 1893), given in fifteen grain doses, twice, with an interval of three hours. I have tried this in two cases of renal hæmaturia. In one the bleeding stopped after the second dose. In the other the drug was, through inadvertence, continued for five days without

having the least influence, thus bearing out with curious exactness the results of Wright's observations. In all probability this will entirely supersede for this purpose the other drugs, such as tannic and gallic acids, acetate of lead, sulphuric acid, turpentine, etc., which have hitherto been recommended.

Ice may be applied over the pubes, against the perineum, and in the rectum, but the application must be continuous and kept up for some hours to have any effect.

If a catheter must be passed for other reasons (such as the relief of retention) advantage may be taken of the opportunity, supposing the hæmorrhage continues, to wash out the interior with cold water, or with dilute astringents, of which tincture of matico and tincture of hamamelis are the best. But it is rarely necessary to pass a catheter merely for the sake of washing out coagula. They gradually melt down and come away of themselves, taking many days in the process if the hæmorrhage was at all extensive. Of course if septic decomposition occurs, an aspirator must be passed, or the largest sized catheter that the urethra will admit, and the contents cleared out with the least possible delay.

In those exceptional instances in which the bladder is so enormously distended from a continuance of the hæmorrhage that the condition becomes dangerous, supra-pubic cystotomy should be performed, the coagula cleared out, and the bleeding stopped by the injection of hot water (temp. 110° F.), or by the actual cautery, or by inserting a catheter in the urethra, and plugging the space around it with iodoform gauze. Such extreme measures are very rarely required; but clearly if the hæmorrhage continues death will ensue from the loss of blood, the intense pain, and the suppression of urine; and no permanent benefit can be gained by passing an aspirator and drawing off some of the contents.

Persistent hæmorrhage should lead to the suspicion of ulceration, or of a polypoid adenomatous outgrowth. The diagnosis can sometimes be made with the cystoscope; but if this cannot be passed, or if the prostate is of such a shape that much of it cannot be seen, and the bleeding continues in spite of the ordinary remedies, supra-pubic cystotomy should be performed. Digital exploration through the prostatic urethra is only to be preferred when the evidence points to the presence of an outgrowth in the urethra, and not in the bladder.

CALCULUS.

Calculus is an exceedingly common complication of enlargement of the prostate, especially after septic cystitis has set in; and it is to be suspected whenever the inflammation is unusually severe and persistent, and resists ordinary methods of treatment. In many cases the diagnosis is of very great difficulty, owing to the way in which the calculi gravitate into the post-prostatic pouch. They never come into contact with the neck of the bladder; do not, therefore, cause the ordinary symptoms, and cannot be reached in the ordinary way.

The treatment necessary for their removal does not come within the scope of the present work; but the frequency with which they occur, especially in the severer forms of cystitis, and the difficulty of diagnosis, except by digital exploration of the post-prostatic pouch, are additional arguments in favour of supra-pubic cystotomy for this condition, and not mere tapping, either supra pubes or through the perineum.

CHAPTER X.

THE RADICAL TREATMENT OF ENLARGEMENT OF THE PROSTATE—RECTAL, URETHRAL, PERINEAL, AND SUPRA-PUBIC OPERATIONS.

ENLARGEMENT of the prostate is a purely local affection. The consequences that follow it are due primarily to the obstruction it causes and the congestion that attends it. By timely removal these consequences can be prevented, and a radical cure obtained.

It is true that many cases, probably two-thirds of those in whom enlargement occurs, do not require treatment of any kind. The obstruction is so slight and the power of the bladder so good that the proper balance is maintained throughout life, and the patient remains unconscious of the existence of the outgrowth until the end.

It is also true that many others who do suffer from it live in a fair degree of comfort, some for the rest of their lives, most for a time, by passing a catheter at more or less frequent intervals, and following out a prescribed *régime*.

But it is also true that in a very large number the symptoms from the first steadily grow worse. The loss of power may be slow; for a time it may be interrupted altogether; but, looking at the case month by month, and still more year by year, the change is unmistakable, and always in the same direction. The catheter has to be used more frequently. The irritability of the bladder is greater, and the residual urine more abundant. In such, the end, if the same treatment is persisted in, does not admit of doubt. The only way in which the consequences can be averted is to remove the obstruction before the changes it has caused in the bladder and kidneys are too far advanced.

Without going so far as to agree with Prof. Broome when he says that systematic catheterism ought never to be instituted, I cannot help thinking that the dread with which it is regarded by the laity is exceedingly well founded.

There are four routes through which the prostate can be approached: the rectum, the urethra, the perineum, and the

bladder, after this has been opened supra pubes. The different methods will be described first, and then the merits of the most promising considered in detail.

RECTAL OPERATIONS.

It is said that a considerable reduction in size has been effected by galvano-puncture, introducing the negative pole of a battery into the substance of the gland through the rectum (Biedert, "Deutsch. Med. Woch.," 1888, xxi., p. 412; Ueber Galvanopunctur der Prostata, "Zeitschrift für Therapie," Wien, 1883). The patient is laid upon his side and the bowel washed out with corrosive sublimate lotion. The positive pole, in the shape of a large plate, is applied to the surface of the abdomen; the negative one, terminating in a platinum needle, insulated with varnish, is driven through the mucous membrane. Casper ("Berl. Klin. Woch.," 1888, p. 461) made use of a current of from twenty to twenty-five milliampères, and prolonged the sittings for upwards of fifteen minutes, changing the position of the needle from time to time.

According to the account that he gives there is very little pain, merely a burning sensation at the end of the penis, but upwards of twenty sittings are necessary. Roux (Société Vaudoise de Médécine, 1888), of Lausanne, however, who employs a much stronger current, rising to seventy milliampères, and who makes several punctures at different places during each sitting, describes the suffering as very severe. Biedert found great improvement in one case out of five. Casper claims to have cured two out of four, but the amount of residual urine, though diminished, appears to have been very considerable still, and one of the four was left with a rectal fistula. Of Roux's six patients, one did not return after the first application; in four, the gland diminished in size, and one was under treatment still. It is to be noted, however, that in all of these cases other treatment was employed at the same time. Casper, for example, not only made use of the ordinary measures adopted in such cases, but employed a stiff instrument to compress the prostate and force it down. Moreover, no evidence is brought forward to show how much of the reduction in size was due to permanent changes in the gland, and how much simply to the cessation of congestion and cystitis; and further, even if the diminution is proved to be the direct consequence of the puncture, it must always be remembered that it does not follow

that the electric current was in any way the real agent—simple perforation, it is well known, is sometimes followed by the same result.

URETHRAL OPERATIONS.

The only ones that require mention are Mercier's and Bottini's; and of these the former has been so often described and discussed already, especially as regards the value of the result obtained by it, that were it not for the fact that Gouley, of New York, has recently attempted to revive it I should pass it by altogether.

Mercier ("Recherches sur le Traitement des Maladies des Organes Urinaires," Paris, 1856) made use of two kinds of instruments, one shaped like an ordinary sound with a cutting blade concealed in the bend, for incising the prostate; the other for removing portions from it, made something after the fashion of a lithotrite with a male blade sliding backwards and forwards in a female one, and with, in addition, a spear to transfix the portion seized so that it should not slip from the grasp of the instrument. Gouley's is practically the same, the main difference being in the greater inclination of the male blade to the shaft, so that when the instrument has been introduced into the bladder it can be withdrawn backwards over the obstruction more easily, and in the edge being flattened instead of sharp. With this it is possible to punch out a segment three millimetres by nine, the blood flowing out through a small channel in the shaft. Gouley ("Amer. Surg. Ass.," iii., 1885; "New York Med. Journal," 1890) has operated upon six occasions through the urethra, three by simple incision, and three with his special instrument. The former all relapsed within two years. Of the latter one died; the other two are stated to have gained complete control over their bladder, but no details are given. Gouley expresses himself decidedly as preferring the perineal route, and his own opinion as to the value of the penile operation may be gathered from the directions that he gives with regard to after-treatment—an instrument is to be passed every five days during cicatrization to dilate and depress the vesical orifice, and a catheter introduced every day for the double purpose of irrigating the bladder and maintaining the patency of the opening. Swinford Edwards ("Lancet," July, 1885)—who, so far as I can ascertain, is the only surgeon who has practised this operation to any extent in England—has found it even more unsatisfactory.

Six operations were performed upon four patients (in two cases it was repeated) ; no bad symptoms of any kind followed, and the function of micturition was restored in all, showing that the outgrowth was really the cause, and the condition of the bladder not beyond recovery; but the improvement was very transient, lasting for only a month, and in the two cases in which the operation was repeated the old trouble returned even more quickly than it did after the previous sitting. Taking these facts into consideration, and also the circumstance that the operation—probably because it is done in the dark—is by no means so devoid of danger as it has been represented to be (in two cases at the Hôtel Dieu, Laugier met with very severe hæmorrhage, one patient dying in six days, probably from loss of blood, as it is stated the catheter was frequently obstructed by clots, and the other in a month), I do not think that the estimation in which the operation is usually held requires revision.

Bottini ("Centralblatt f. Chirurgie," 1885, p. 494 ; "Archiv. Klin. f. Chirurgie," xxi. ; Internat. Med. Congress, "Berlin Klin. Woch," Nov., 1890 ; "Lancet," 1885, i., p. 582) makes use of the galvano-cautery in much the same way through the urethra. One of his instruments resembles Mercier's prostatome, except that instead of an edge of steel, two small platinum plates are fitted into the bend parallel to each other and 1 m.m. apart. Each is $\frac{1}{3}$ c.m. in breadth, and 2 c.m. in length. The ends that lie towards the beak of the instrument are joined together ; the others are attached to two copper wires running in the shaft, which contains also a pair of tubes for the circulation of cold water. In the other instrument the cautery, which is bent round into the form of a loop, is concealed and insulated in what would correspond to the male blade of a lithotrite.

No anæsthetic is required and no water need be injected into the bladder, but it is as well that the urethra should have been accustomed to the use of instruments. When the point is in the bladder, it is turned downwards as in searching for a stone, and gently drawn outwards until it is felt that the beak is in contact with the obstruction. If there is any doubt, the exact position of the instrument should be ascertained with the finger in the rectum. The current is then turned on and the curve pressed against the hypertrophied tissue, a stream of water being made to circulate through the instrument so as to prevent the shaft becoming too hot. By gently

elevating the handle the platinum can be made to burn its way slowly through, a hissing sound being distinctly heard. Then the end of the instrument is pushed into the bladder and allowed to cool down. If the scab sticks to it, it must be burnt off.

The current required to work effectually must be of considerable strength, sixteen to twenty ampères. Bottini makes use of accumulators, but if the patient's house is supplied with the electric light, and the current is an alternating one, the required amount can be more easily obtained by means of a Woakes' transformer.

Bottini claims that he can produce an eschar one c.m. in depth in one minute, and twice as deep if the application is prolonged for another. The scab usually separates about the tenth or fifteenth day. According to the latest account he has operated upon seventy-seven cases in all. Of these, two have died (it is only fair to say that they were among the very earliest); in twelve there was no result; in eleven some improvement; and in fifty-two complete cure. In England the same method has been employed by one or two surgeons—Bruce Clark ("Brit. Med. Journal," October, 1889), who describes three out of four cases in which he used it, as being cured, and Hurry Fenwick, who, on the other hand, failed to meet with any success.

Bottini's operation shares with Mercier's the grave disadvantage that the whole of it is performed without any definite knowledge, other than can be obtained by urethral exploration, of the size, shape, and position of the obstruction.

It is of no use in cases of advanced disease. For these Bottini recommends that the obstruction should be tunnelled. Nor is it of service when the growth has spread into the bladder and become vesical—a form which frequently gives rise to the most intense irritation, so that the patient is often sounded time after time for calculus. A small obstruction confined to the posterior wall of the urethra, just at its commencement, without enlargement of the lateral lobes, can undoubtedly be removed; but such cases are rare, and it is rarer still to find that when the condition is diagnosed the patient considers that treatment is necessary.

On the other hand, this operation is sometimes of great service in another way. In a considerable proportion of cases the earlier symptoms of the disease (and, indeed, those that occur throughout the whole course, more or less) are due almost entirely to congestion of the mucous membrane at the neck of the bladder and

along the posterior median line of the first part of the urethra. This is the cause of the irritability of the bladder, of the increased frequency of micturition, of the obstruction at the outlet (to some extent), of the residual urine in part, and, later, when it becomes chronic, of the degeneration of the wall of the bladder. A vicious circle is established ; the congestion makes the bladder irritable, and the constant straining makes the congestion worse. Bottini's operation breaks this circle effectually, and almost without risk. The cautery, cutting into the mucous and submucous layers, destroys the venous plexuses, and the dense cicatrix that it leaves finishes the work. It does not stop the enlargement of the prostate, and can have little effect upon valvular outgrowths, but it does prevent many of the distressing symptoms to which the enlargement gives rise, and by stopping the congestion it can, at least, delay the consequences that follow.

This method may be employed with better results through the perineum, as recommended by Watson (*loc. cit.*). The incision necessary is exceedingly small, but it enables the finger to be introduced, and the condition of the prostate and the neck of the bladder to be ascertained with accuracy, thereby removing one of the great drawbacks to Bottini's method without sensibly increasing the risk.

Newman ("Brit. Med. Journal," 1887), of New York, speaks very highly of the application of instantaneous flashes of the galvano-cautery to the mucous membrane lining the prostate.

The instrument, which is shaped like a catheter, has two copper electrodes running down the shaft, and a serpentine piece of platinum wire contained in a hollow at the bend. By means of an electric current (the strength of which has to be graduated empirically), this can be momentarily heated to a high red colour. Many sittings are required, and two or three flashes are given at each sitting, each flash producing a white film upon the surface of the mucous membrane, like that caused by the application of nitrate of silver. The method does not seem, however, to have recommended itself.

PERINEAL OPERATIONS.

The enlargement may be approached either from the urethral or the cutaneous surface. In the former case external urethrotomy is performed, and the prostatic urethra explored through the open-

ing; in the latter a longitudinal incision, or, if more space is wanted, some modification of Zuckerkandl's * for the exposure of the lateral and under surface of the bladder is adopted.

Various drugs (iodine, ergotin, sclerotic acid and others) have been injected into the prostate through the perineum, but it has never been shown that any benefit has followed.

a. *From the cutaneous surface.*

Wishard ("Journal of Cutaneous and Genito-Urinary Diseases," March, 1892) states that in four cases under his care marked diminution in the size of the rectal tumour followed puncturing the lateral lobes with a small curved galvano-cautery point. "The latter was used through a Fergusson's rectal tube introduced through a perineal opening, and inspection was aided by reflected light from a head mirror. The punctures were made to the depth of one-half to three-quarters of an inch, and from two to six in number. Definite location of the desired point of insertion of the cautery may be obtained by digital and ocular examination. A small straight tenaculum passed along the finger secures the objective point, and the tube being then passed into the wound over the tenaculum, the secured mass can be more fully exposed by being drawn into the mouth of the tube. In the cases thus treated no ill effect was observed. Prolonged drainage was used, and the small resultant slough occasioned no inconvenience."

"How much of the diminution in size of the rectal mass was due to the removal of congestion by rest secured by drainage it is difficult to estimate. The use of the cautery in this manner would seem to be restricted to small salient growths, and to a limited extent in the reduction of general enlargement of the lateral lobes."

* Zuckerkandl's incision ("Wiener. Med. Press," 21, p. 857, 1889). The patient is in the lithotomy position. An incision, two inches and a half in length, is made transversely across the perineum, a little over an inch in front of the anus. From the two ends of this incision the knife is carried backwards and somewhat inwards towards the middle line for an inch and a quarter. The flap is dissected up until the prostate is exposed. It is then turned back, carrying the rectum and anus with it, and laying bare the trigone, vesiculæ seminales, and vasa deferentia. By drawing the rectum backwards the peritoneum is put upon the stretch, and if required can be easily pushed up, so that the whole of the posterior wall of the bladder is open to careful examination. Langenbeck's incision, under the pubic angle, in comparison with this, does not give enough room, and is liable to wound the prostatic plexus.

Removal of a wedge-shaped segment from the under surface of the lateral lobes through a perineal incision has been practised with some success by Küster. It was first devised by Dittel ("Wiener. Klin. Woch.," 1888-1890; "Wiener. Med. Woch.," Nov., 1890), who, however, only tried it on the dead subject. The idea is that the inner surfaces of the lateral lobes will recede from each other and leave the urethra open. The patient may be placed either in the prone or the lateral lithotomy position. The bladder is emptied, a catheter tied in, and the rectum filled to establish its position and to avoid injury. The external incision is carried from the tip of the coccyx, around the sphincter ani, to the median raphe in front. This opens up the ischio-rectal fossa freely. Then the rectum is separated from the right lobe of the prostate, and the latter carefully exposed. A little further dissection beyond the middle line enables the same thing to be done upon the other side; and then as soon as the bleeding has ceased, and a good view can be obtained of the parts exposed, a wedge-shaped piece can be removed from each. This was proved by actual demonstration upon the dead subject to be capable of relieving prostatic obstruction when due to increased thickness of the lateral lobes; it allows their urethral surfaces to fall apart from each other, and restores the shape of the canal, which in such cases is practically compressed into a slit.

Küster (Langenbeck's "Archiv.," 91; "Proceedings of 20th Congress of German Surgeons") has performed this operation upon three occasions. In one only was there much bleeding from the prostatic plexus; but in one the membranous part of the urethra was opened unintentionally (after an incision had been made in the prostatic portion); and in one the vesicula seminalis of the left side was cut into. The wounds were in all cases plugged with iodoform gauze and sutured a day or two later. In two instances (in both of which the urethra was opened during the operation) fistulæ persisted, though one, it is true, was very small; and in one case the residual urine still amounted to fifty cubic centimetres.

As, however, the lateral lobes so far as they are obstructive can be dealt with as easily and more effectually by the supra-pubic or the combined method of Nicoll, it is not likely that this operation will be frequently required.

Portions of the prostate have frequently been excised or twisted

off during the performance of lateral lithotomy. Nearly every surgeon of much experience in this operation has placed one or more upon record. In most the removal has been accidental—a pedunculated median growth being caught in the angle of the forceps behind the stone and torn away, as described by Syme, Fergusson, Paget, Cadge, and others; or a rounded isolated mass shelling out from its bed under the pressure of the finger, as described by Bickersteth, who removed in this way a tumour the size of a hen's egg. In others, however, it has been done of set purpose after the stone has been removed and the condition recognized by the finger. Bryant has recorded one; Reginald Harrison another; Ashhurst, of Philadelphia, a third; Sir H. Thompson two more; and Landerer a sixth. More rarely the lateral lobes have been torn away, as in Dittel's case, in which, while extracting a calculus by the median route, at the third attempt he pulled out both, together with the stone; and in another of a somewhat similar character, mentioned in the "St. Bartholomew's Reports for 1885," where, on a patient dying a year later, only a small cavity, lined with a thin capsule of prostatic tissue, was found to mark the site of the gland.

In a few of these cases there was permanent improvement in micturition, notably in Landerer's, in which the patient was enabled to dispense with the use of the catheter, and none seem to have been in any way the worse; but in the majority there was no difference one way or the other. Nor is this to be wondered at. In nearly all the part that was removed was either a pedunculated median growth, or an isolated tumour that was accidentally exposed and sometimes divided by the lateral incision. But it is quite the exception to find either of these conditions developed sufficiently to act as an obstruction, without at the same time great modification in the rest of the gland. It is true, as Thompson suggests in the account he gives of his own four cases, that the muscular coat of the bladder never recovered; in most it never had the chance—the whole, or even the greater part of the obstacle was not removed.

b. *From the urethral surface.*

Of operations through the prostatic urethra, after this has been opened from the perineum, there is the usual variety. The gland may be incised in the middle line with a bistoury, and split open down to the firm tissue beneath, by the pressure of the finger or a

director; or it may be transfixed from below and a V-shaped piece excised. Pedunculated outgrowths may be removed with an écraseur or twisted off with forceps. Isolated tumours in the substance of the gland may be shelled out as soon as they are exposed by division of the tissues covering them. Portions of the gland may be punched out with a prostatome, as practised by Gouley and Norton; and, finally, as suggested by Watson, a channel of sufficient depth may be burnt through the obstruction with the galvano-cautery.

It is plain at the first glance that an operation performed in this way must be much more thorough and satisfactory than either Mercier's or Bottini's. Some idea can be formed as to the size and character of the obstruction, and a much larger amount can be removed; but it is also true of this that it is only suited to a limited number of cases, and those not the worst, or requiring operation the most.

For anatomical reasons it must fail in a very large proportion; the space is too small; there is not room for the necessary manipulation. A small pedunculated median lobe can be removed, or a V-shaped channel can be punched out or burnt out from the posterior margin of the vesical orifice; but this is the limit. Nothing can be done for the lateral lobes if they are enlarged. Vesical outgrowths, which, as Fergusson long since pointed out, are often the most serious from the intense irritation they cause, almost as bad as that attending phosphatic calculi, are quite beyond reach. A median lobe of any size, even if it is pedunculated, can only be extracted through the narrow outlet in fragments, and as the urethra in such cases is usually compressed into a cleft by the growth of the lateral masses, this entails such an amount of manipulation and bruising that the rest of the gland is almost certain to slough, and either cellulitis sets in or the patient's strength is unequal to the task of repair. One case that was under my care proved fatal from this cause ten weeks after the operation. The overgrowth affected chiefly the lateral lobes; above and between them there was a fold that contained a certain amount of prostatic tissue; this was divided, but as the passage was not even then sufficiently free, an attempt was made to enucleate the lateral portions as well. No great amount of difficulty was experienced; upwards of a dozen rounded masses were shelled out with the finger and withdrawn; but the wound was never repaired; the cavity did

not contract; the walls remained covered with sloughs; secondary hæmorrhage set in, although not to any great amount, and the patient died from exhaustion. (Paper by author, "Lancet," July, 1892.)

The increase in the distance of the urethral orifice of the bladder from the surface of the body—the perineal distance, as Watson has called it—is another and more serious difficulty, rendering this method of operating simply impossible in a large proportion. If it is more than three inches the finger cannot reach the bladder, much less explore the interior around the outlet. It depends partly upon the condition of the perineum, whether it is rigid or loaded with fat, partly upon the extent to which the lateral lobes have grown up and carried the bladder before them. So long as the perineum is soft and yielding the prostate and the neck of the bladder possess a considerable range of mobility during life; they can often be pulled down within reach, and quite half an inch gained. In two of the cases in which I operated by this method I was very much struck by this. In neither was it possible at first to enter the bladder, but by passing a short, sharply curved sound by the side of the finger, and hooking it against the trigone, the whole of the ring could be brought down and examined with ease. Unhappily, in the majority of cases of enlarged prostate, the rigidity of the tissues makes this impossible; and of course the lengthening that is due to overgrowth of the lateral lobes is unalterable.

Watson, in his admirable monograph on the "Operative Treatment of the Hypertrophied Prostate," states that although his finger is of full average length, he must have failed to reach the bladder in at least one-third of the thirty cases which he has figured, and which he examined with this object in view. With regard to this, however—although I believe his conclusions are in the main correct (and he writes to me that now he is not nearly so much in favour of the perineal route as he was then)—I would venture to point out that the specimens upon which they were founded were taken from a museum, in which, presumably, they had been preserved because of the way in which they illustrated the final effects produced by enlargement of the prostate, and without any reference to their clinical history. It does not follow that operation was required or would have been advisable in all or any of these. It is not the mere fact of overgrowth, however great this may be, that renders operation justifiable, but the obstruction and the irritability caused by it; and no conclusion, such as that drawn by Watson, is warranted

until the perineal distance has been measured in a series of cases in which operation by one route or the other is considered advisable. For this reason, McGill's observation, that in only three out of his first twelve cases would it have been practicable to remove satisfactorily the projecting portion of the prostate by the perineal route, is of more value, and probably gives the true proportion.

Division of the prostate in the middle line, described by Harrison as a suggestion of Guthrie's ("Trans. Inter. Med. Congress," 1884), is the simplest of these operations by the perineal route. "It consists in opening the membranous urethra from the perineum on a guide, and introducing the finger within the prostatic urethra. The obstructing portion is then divided in the middle line, partly by incision with a probe-pointed knife, and partly by divulsion with the finger, or a large sized bougie, until the access to the bladder is felt to be free. In some instances I found it better to make the prostatic incision from within outwards, with a curved, probe-pointed bistoury. Unless this is done the division may be incomplete. In performing this operation it is not desirable to make an opening larger than will admit the index finger from the perineum into the bladder. Such an opening is completely filled up by the drainage tube, and consequently but little risk of hæmorrhage need be entertained." ("Lect. on Surg. Diseases of the Urinary Organs," 4th ed.). The patients are allowed to get up in three weeks' time, and are fitted with one of Annandale's rubber tubes. This may either be closed with a stop-cock or connected with a portable urinal, according to the requirements of the case. After a period varying from six to twelve weeks it is found either that the urine passes down the urethra voluntarily or that a catheter can be introduced without difficulty, owing to the way in which the prostate has contracted. The tube is then withdrawn, the opening allowed to close, and a bougie passed occasionally.

This operation, by itself, without being supplemented by further measures, such as drainage, is of very little use. The few cases in which it has succeeded probably owe the benefit they have derived almost entirely to the congestion of the gland having subsided. Nor could it well be otherwise. As soon as the neck of the bladder has recovered from its temporary distension, its natural elasticity and the action of the muscular fibres that surround it bring the torn or divided surfaces together again, and though a small amount of the growth may be lost by suppuration or sloughing, it is not enough

to effect any permanent change for the better; the obstruction is soon re-established, and becomes as prominent as it was before.

The prolonged retention of a drainage tube, which is strongly recommended by Harrison as an accessory to division, is much more successful. Various instruments have been devised for the purpose, and Watson's ("Operat. Treat. of the Hypertrophied Prostate") may be taken as an example of one of the best. Its end occupies the lowest part of the bladder, and the eye is so placed that there is no *cul-de-sac* beyond. Its calibre is of full size; the shaft corresponds in direction with the posterior part of the urethra into which it fits, while its external portion is parallel with the bed when the patient is lying upon his back, and it is fastened by tapes attached to a plate, which is so arranged that while it can be pushed backwards and forwards upon the tube to accommodate itself to the difference in depth of the perineum, it will remain at any point at which it is placed. How a tube of this kind acts when retained for many weeks is a matter of opinion; it cannot be simply mechanical dilatation; possibly the more or less friable tissue of which the prostate is composed undergoes at first a certain degree of disintegration around it, and then slowly heals over so as to leave a canal of greater width; but undoubtedly it greatly increases the chance of success. Of the eleven cases published in the statistics appended to my "Hunterian Lectures" in which there is mention of drainage for any length of time (and it must be for some weeks to be of any service, though the patient is not necessarily confined to bed), six are returned as cured and two as much improved. Two, however, were distinct failures; a third was very little benefited, and in one of the successful ones a small fistula persisted. Leaving this aside for the time, the cause of the failure is of some importance. It is not now the recurrence of the obstruction, but decay of the expulsive power of the bladder. A catheter could be passed much more easily; the route was and remained open; but the cystitis had lasted such a length of time that the muscular coat was damaged beyond recovery; the fault was not in the operation, but in the operation having been delayed too long.

"The operation should be regarded as that of choice in all those cases in which with marked diminution of expulsive force and with cystitis there are also evidences of wide-spread degenerative changes or of distinct renal disease, and toxæmia and general feebleness are present. It is also to be preferred as a rule even in the absence

of renal or constitutional symptoms if the bladder is rigid and contracted, and will hold only a few ounces of urine, or if the atony is nearly absolute, and does not tend to improve under careful treatment.

"The precise mode by which it acts has not been demonstrated, but it seems probable that it is a combination of mechanical dilatation of the channel with a certain amount of cicatricial contraction in the substance of the gland, reducing its bulk in the immediate vicinity of the urethra, and thus diminishing its obstructive power" (White, "Annals of Surgery," 1893).

The galvano-cautery has been applied to growths around the neck of the bladder through the prostatic urethra by Wishard (*loc. cit.*) on several occasions. A cylindrical rectal speculum, with an aperture three-quarters of an inch in diameter, was passed first through a perineal incision in order to protect the mucous surface. And Watson (*loc. cit.*) has devised a galvano-cautery prostatectatome which may be used either through a perineal wound or after supra-pubic cystotomy. "It has the form of a short, broad bladed lithotrite, each blade being reduced to a thin edge by a large central fenestrum of oval shape. Each blade bears a rim of petrified wood for the purpose of isolating the loop of platinum wire which rests upon the surface of the inner blade, after emerging from the hollow inner shaft, through which the wires are conducted to the battery connections. The obstructing portion of the prostate may be grasped between the two blades, and its central portion removed, or the whole taken away piecemeal as its form may dictate, by pressing the blades together, the wire being heated by the electric current."

Bottini's instrument may be used in the same way, avoiding many of the disadvantages that attend the urethral method. The size and shape of the obstruction, for example, can be made out with the finger. The bladder can be drained, and any hæmorrhage that occurs either during th operation or later, when the sloughs are beginning to separate, can be dealt with more easily. The operation may be a little more severe than the urethral, and the patient may have to keep in bed a few days longer, but it is certainly more efficient. It is of no use when the growth has attained a large size, but in the early stages of the disease, in cases in which congestion and irritability are the most prominent features, it may be employed with much success.

Gouley ("American Surg. Ass.," 1885), who, as already mentioned, adopted Mercier's method of penile prostatectomy, on four occasions carried out a similar proceeding on a more extensive scale through the perineum. "The instrument resembles an ordinary lithotrite, and its mechanism is very simple. It consists of a male and female blade, one sliding in the other. The male blade is hollow, its sides are vertical, and its superior portion a little rounded. It is welded to a tubular shaft, in the centre of which is a long needle, worked by a button at the proximal extremity of the handle. The object of this needle is to transfix the prostatic valvule or tumour and hold it in position from the moment it is seized until it is cut and extracted, the cavities in the two blades rendering extraction certain. The inclination of the male blade is such that it will ride easily over the valvule as a preparatory step to prehension, whereas in Mercier's instrument the same blade is bent so abruptly that it is with the greatest difficulty carried over the valvule, and I have found it impossible in some instances. Again, what in Mercier's *exciseur à hameçon* is a cutting edge, in mine is a flat edge, so that it really acts as an écraseur. This instrument will cut or punch out a segment of the valvule three m.m. by nine. The back is hollow to receive the piece of the valvule, in part, at least, and has a small orifice at its extremity, which serves the double purpose of allowing a little water to escape and making sure the bladder has been reached, and of forcing out any blood oozing from the cut which might otherwise coagulate, fill the cavity and interfere with the proper lodgment of the segment of the valvule. The shaft of the female blade is cut sloping for four c.m. to its junction with the back, so as to give more depth to the male blade. Marks one c.m. apart on both surfaces of the screw apparatus indicate the extent of separation of the blades during seizure of the valvule and consequently its thickness.

"To seize and punch out a piece of the valvule the instrument is introduced locked; the beak is reversed as soon as it has entered the bladder, and the screw turned from right to left, so as to open the blades or jaws, when the male blade will pass over the valvule and drop in front of it into the prostatic sinus. The instrument, still locked, is moved to and fro that the operator may know that it is in proper position; then the needle is thrust through the valvule until its point has entered a shallow pit in the posterior wall within the female blade. The screw is now turned

from right to left until there is a slight resistance. The operator casting his eye upon the handle at once ascertains the thickness of the valvule he is about to cut. A few slow turns of the screw which drives the male blade home will complete the section, or écrasement, with a peculiar crunching sensation, such as is never experienced in any other operation. The instrument, holding the segment in its closed jaws, is pushed into the bladder and then slowly withrawn. Contrary to Dr. Mercier's injunctions, I have retained a catheter in the bladder for twenty-four hours in some of my cases. The after-treatment consists in the introduction of an instrument to make dilatation and depression of the urethral vesical orifice once every five days to retard the process of cicatrization."

Norton ("Med. Press and Circular," Jan., 1892) has adopted a somewhat similar plan, gouging out the central line of the middle lobe. The instrument he has devised is not unlike Gouley's. "It consists of two blades moving on the principle of a lithotrite. Both blades are cutting with keen edges, not riding over each other, but fitting edge to edge. The sliding blade, instead of rising at a right angle from the stem like a lithotrite, rises with a long incline in order to slip back over the middle lobe of the prostate when both blades are in the bladder. The cutting edges are in the form of a scoop with a hollow within, which receives the section of the prostate when cut away.

"The mucous membrane is probably not severed, because there is always difficulty in cutting through mucous membrane; but on withdrawing the instrument it is drawn into the perineum and cut through with a knife."

Norton advises operation in all cases where the continual use of a catheter is necessary before the onset of those symptoms which are so well known to accompany the last stages of prostatic obstruction. After the operation he recommends washing out the bladder with boracic acid lotion every half-hour for the first ten hours and every hour for the next twelve hours through a prostatic tube in the perineum connected by a long rubber tube with a vessel under the bed. The tube, which need not be a large one, may be removed within a week.

I have given this description of Gouley's and Norton's instruments at length, because their method appears at first sight to have a good deal to recommend it, and it is not likely that anyone will

be able to devise a better contrivance for the purpose. The class of cases, however, to which it can be applied is a very small one. The lateral lobes cannot be touched. Vesical outgrowths are beyond reach; and it is not possible to deal in this way with a median growth of any size.

Other methods of removing obstructing masses through the prostatic urethra have been adopted in special cases. In one instance I passed a wire loop around the neck of a valvular upgrowth, guiding it into position by means of the finger in the urethra. In another I divided the mucous membrane on each side and shelled out numerous isolated growths, partly with the fingers, partly with a closed pair of scissors. And in other cases outlying portions have been seized in polypus forceps, and either crushed or twisted off.

The cases that are most suitable for perineal prostatectomy are those in which there is a small valvular outgrowth hanging over the orifice, and nothing more; those in which the symptoms are mainly dependent upon congestion of the mucous membrane at the neck of the bladder; and late in the course of the disease under the conditions mentioned in connection with prostatotomy. It must be clearly made out beforehand that the whole of the symptoms are due to changes in the median posterior wall of the urethra or the neck of the bladder, and that the perineal distance is under three inches. (If the perineum is soft and yielding an extra half inch can be gained when the patient is under an anæsthetic by passing a short, sharply-curved sound by the side of the finger, and hooking it against the trigone.) Given these conditions very great relief may be obtained with very small risk.

A valvular outgrowth springing from the median or lateral lobes can be easily removed by snaring or twisting through a very small incision. Afterwards, if there appears to be much resistance at the margin under the base of the growth, a channel can be cut through it with the cautery or an instrument like Watson's or Norton's.

In certain cases the prominent symptom from the first is intense irritability of the bladder, kept up by the congestion of the mucous membrane. There is not a large amount of growth, and but little residual urine. But the lining membrane is swollen and thickened, the surface is very tender, and the muscular walls are in a state of constant spasm. Sometimes this is relieved by the careful daily use

of the catheter, and by great attention to diet. More frequently the catheter is not well borne, and the urethra becomes more sensitive each time it is used. In these cases complete relief may be obtained by cutting a channel with the cautery through the congested layer. In all probability the success that has attended such a large proportion of cases treated after Bottini's method is due to this, but the division must be more thorough and more certain than is practicable through the urethra. Whether relief will be permanent in all cases time alone can tell. Probably not, for though the congestion is checked the growth of the gland may still continue. But at least it is of some advantage, with so little risk, to be able to dispense with the use of a catheter for some years, and to be in no worse a position at the end of that time.

Finally, in the later stages of the disease, perineal prostatectomy may often be substituted with advantage for prostatotomy. It is more thorough, without appreciably greater risk, and does not require prolonged drainage afterwards to ensure a successful issue.

It is true that the mortality, according to the statistics appended to my "Hunterian Lectures," appears to be considerable (upwards of 14 per cent.), but this is entirely due to the fact that the cases were not properly selected, and did not conform to the above conditions. Too much was attempted. Enlarged lateral lobes, for instance, cannot be dealt with by this route. Cases in which this is attempted must not be reckoned with the rest. If they are omitted the rate is very much lower, and will become lower still.

The combined operation (perineal and supra-pubic) stands on entirely different ground, and will be dealt with later.

SUPRA-PUBIC PROSTATECTOMY (MCGILL'S OPERATION).

This operation, which had already been performed on several occasions by Dittel ("Wiener. Klin. Woch.," July, 1888), Trendelenburg ("Beiträge zur Klin. Chirurgie," Tübingen, Band viii., 1891), Belfield ("New York Med. Record," August, 1886), and Benno Schmidt ("Arbeit. aus d. Chir. Univ. Poliklinik," Leipzig, 1886; and "Münchener Med. Woch.," Feb., 1889), first became generally known after the publication of McGill's three cases before the Clinical Society in 1888. To this and to the subsequent account given at the meeting of the British Medical Association, in August, 1889, by McGill and his colleagues at the Leeds General Infirmary, this operation owes its present position.

The preliminary steps are the same as those required for supra-pubic cystotomy. The pubes should be shaved, thoroughly scrubbed with soap and water, and covered with a carbolic compress the day before, and an enema given the morning of the operation. As soon as the patient is under the anæsthetic the bladder is emptied and carefully washed out with warm boracic lotion until the fluid returns perfectly clear. How much should be left in the bladder depends upon what is known beforehand of its size. In most cases it should be sufficient to enable the bladder to be felt when deep pressure is made behind the pubes, that is to say, from eight to ten ounces.

A soft, well-made rectal bag, without seams, and pear-shaped, may be used in these cases. The object is not so much to raise the prevesical fold of peritoneum as to lift up and steady the prostate during the subsequent manipulation after the bladder has been opened. The amount injected into it varies with the capacity of the rectum, but, as a rule, the maximum advantage is gained with not more than six ounces. More than this rarely does any good, and may do a good deal of harm.

Trendelenburg's position should be adopted if the patient's respiration is sufficiently good when under the anæsthetic; when the patient is horizontal the posterior wall of the bladder, as soon as the contents escape, is pushed by the intestines down into the cavity, filling it up, so that manipulation is difficult.

The superficial and deep incisions are the same as in supra-pubic cystotomy. The prevesical fold of peritoneum, if it is seen, must be lifted up from off the front of the bladder. Usually it is well out of the way. And the greatest care must be taken to disturb as little as possible the loose cellular tissue and fat that lies between the bladder and the posterior surface of the pubes.

The opening in the bladder should be made on the most prominent portion of its anterior surface, between the two anterior veins, and should be large enough to admit the forefinger without straining.

The first thing is to ascertain the exact condition of the parts around the orifice, and to determine how the enlargement shall be dealt with. Temporary sutures should be inserted into the bladder wall to hold it up and keep the sides of the incision apart if it seems likely that much manipulation will be required.

McGill advised that the prostate should be removed as far as

possible by enucleation with the finger and not by cutting. The mucous membrane over the projection should be snipped through first, and the rest of the operation completed with finger and forceps. In this way excessive hæmorrhage is prevented. A pedunculated middle lobe can, however, be removed by cutting through its base.

When there is a ring of hypertrophied prostate around the internal urethral orifice, Mayo Robson ("Clinical Journal," March 14th, 1894) recommends that a V-shaped piece should be taken out of the floor. This is best performed by means of McGill's scissors, a cut being made first on one side and then on the other, and the intermediate portion being removed by ring or other forceps. If the lateral lobes are much enlarged, and are obstructing the passage, the index finger can easily be insinuated within the capsule through the incisions already made, and masses can usually be enucleated like small fibroids from a myomatous uterus.

In most cases of enlargement of the prostate this can be accomplished without difficulty, and masses an inch or more in diameter can be removed. McGill, for example (British Med. Assoc., August, 1889), removed both lateral lobes in seven pieces, weighing altogether two ounces thirty grains. Buckston Browne ("Clinical Society Trans," May, 1889) twisted away piecemeal by finger and forceps as much as four ounces in weight. White, of Philadelphia ("Medical News," Dec., 1890), using only a moderate degree of force, enucleated eight pieces from the median and lateral lobes, weighing together three ounces. And the list might be very easily extended.

In other cases, however, in which the symptoms were equally well marked the greatest difficulty has been experienced. The prostate, without attaining any size, has become fibroid in character and intensely hard. In one, for example, McGill failed to remove more than a fragment, the size of a pea. For these other methods must be employed, cutting forceps with blades something like a parrot's beak, but of different lengths and shapes (Keyes); Paquelin's cautery or the galvano-cautery applied through a short vaginal speculum (Benno Schmidt and Kummell); or the instrument devised by Watson.

In exceptional instances other plans have been adopted. Thus Tobin ("Brit. Med. Journal," March, 1891) removed a projecting

median lobe by means of a wire écraseur passed up the urethra, guiding it into position with the finger introduced through a supra-pubic opening. F. N. Otis (communicated by W. K. Otis) on one occasion adopted a similar method, passing the wire upwards through a perineal incision. Chismore, of San Francisco, made use of a chain écraseur. And Belfield ("Int. Journal of Med. Science," Nov., 1890) shelled out an obstructing mass of considerable size by pressure from below through an opening in the urethra.

As a rule, there is not much hæmorrhage: the prostate itself (unless it is inflamed or congested) is not a very vascular organ; but in some cases it has been very profuse. Irrigation with hot water (temp. 110° F., so hot as to be unpleasant to the hand) usually controls it without difficulty. If this fails and the position is of easy access a catgut stitch may be passed by means of a curved needle underneath the bleeding point, or Paquelin's cautery may be applied through a speculum, or a compress soaked in tincture of hamamelis or tincture of matico may be pressed firmly down upon the bleeding spot.

Keyes ("Medical Record," Sept. 17th, 1892) recommends a tampon made of bichloride gauze. A square, four layers thick, is cut first, the length of each side being about six inches. Upon this are placed eight other layers cut square, each side measuring four inches, and upon this eight more, also square, the side measuring three inches. These are all held together by a stout silk ligature passed through the centre and tied on to an ordinary pearl shirt button, the ends of the ligature being left long and projecting from either surface. A similar piece of silk is fastened to each of the corners of the six-inch squares. In one case Keyes passed the central silk ligature from the bladder through the urethra, and by means of it drew the tampon powerfully down into the funnel-shaped excavation; in another the urethra was opened in the perineum, and the ligature was brought out through the wound. If the ligature is double, the pad can be secured with any required degree of pressure by tying the two ends together over a roll of gauze. In removing the tampon, traction should be made through the supra-pubic wound upon the central as well as the corner ligatures, so as to detach it evenly from the raw surface beneath. The urine, as it collects, escapes through the supra-pubic opening, but care must be taken to leave the ureteral orifices free.

Prostatectomy should never be performed shortly after an attack

of retention of urine. Time should be given for the congestion to subside. Not only is the hæmorrhage likely to be more severe, but it is impossible in such circumstances to make certain how much of the obstruction is due to organic overgrowth which will not disappear, and how much to vascular engorgement which will. And in cases of septic cystitis it is sometimes advisable to perform the operation in two stages—drain the bladder first by supra-pubic cystotomy, and then after a few days, when the urine has lost its foul and septic character, deal with the obstruction at the neck.

The amount that must be removed varies with each case. In several three and even four ounces by weight have been excised; in others a fragment only the size of a pea. As, however, it is fairly certain that the risk of the operation increases in proportion, no more should be done than is absolutely necessary.

There are certain indications to act as guides. If the immediate cause for the operation is the intense irritation due to the presence of what is essentially a vesical tumour, the whole of it must be removed. On the other hand, where the urgent symptom is obstruction, the formation of what has been well called a low level urethra, whether it is attained by enucleation, or the cautery, or a pair of cutting forceps, must be the prime object; and in any case, whether there was before a tendency to calculus or not, owing to the liability there is afterwards to the collection of phosphatic *débris*, every endeavour must be made to ensure a smooth and straight route towards the orifice. It seldom happens, however, that the operation is required for one of these causes only; nearly always, even if one appears paramount, the others are present also. Practically if the operation is to prove a success, it resolves itself into removing the whole of the vesical growth whether it springs from the posterior lip of the orifice or from the lateral lobes, and cutting a channel as well.

The lateral lobes, when they are much enlarged, are quite as important as the median part, and require in most cases to be dealt with as thoroughly if permanent cure is the object. One of the most common forms is that in which the sides of the prostate grow upwards, elongating the urethra and compressing it into a narrow slit, until they project into the cavity of the bladder, raising between them a bar which sometimes consists merely of a fold of mucous membrane but more often contains an actual outgrowth of prostatic tissue. Under these conditions excision of the median

obstruction above is of little or no use. As McGill has shown, the projecting parts of the lateral lobes must be removed as well, and then, taking advantage of the division of the mucous membrane and the exposure of the surface of the outgrowth, a sufficient amount must be removed from either side to make the passage really funnel-shaped. Surrounded as it is now by rigid tissues, having lost all its natural flexibility, nothing else will answer.

The exploration must not be confined to the bladder. The first portion of the urethra must be thoroughly examined with the finger. Unless it is perfectly soft and devoid of resistance (which in such cases, where the growth has already spread into the bladder, is highly improbable), either a deep groove must be cut or burnt in the posterior wall, as was done by Trendelenburg, Helferich, Kümmell, and others, or as Belfield prefers, an incision made in the perineum, and the exploration finished through that. As he points out, the addition of the *boutonnière* increases but slightly the injury to tissue and the duration of anæsthesia, while it affords an access to the entire prostate which may convert an utter failure into a complete success.

On this point Belfield lays especial stress. One of the earliest cases (Meinhardt Schmidt's "Deutsche Zeitschrift für Chirurgie," Band 28) failed at first completely. The patient was only fifty-five years of age. The bladder was thick-walled and contained several calculi; the urine was purulent and ammoniacal; there had been complete retention, off and on, for three years. Supra-pubic cystotomy was performed and a broad-based lobe found projecting into the bladder. The projecting part was torn off; the base was left untouched. This was in February, 1888. In March, the catheter was stopped by the prostate as before and median perineal cystotomy was performed. A catheter was tied in; voluntary micturition began to return the next month, and in August, 1890, two years and four months later, recovery was complete.

The same thing almost happened to Belfield himself. The patient was 49 years of age; a catheter had been used irregularly for over a year, the introduction being very difficult and often so painful that the patient neglected it. Supra-pubic cystotomy was performed, and a tumour the size of a walnut enucleated from the left lateral lobe. The finger tip and the catheter then revealed an obstruction in the prostatic urethra inaccessible from

the bladder. Perineal urethrotomy was performed, an incision made along the floor, and the tumour detached and pushed into the bladder from beneath.

Mr. Gilbert Barling ("Lancet," June 10th, 1893) records another case of much interest in regard to this question. Part of the so-called middle lobe had been removed before the patient came under Mr. Barling's care. No benefit had followed. If anything, the condition of the patient was rather worse than before, for, whereas before he had been able to void some urine by the natural route, since the operation he had completely lost the power. "On opening the bladder supra pubes it was found that the prostate was enlarged as a bulky collar surrounding the orifice of the urethra and flattening it laterally. No scar of the former operation could be felt. With large scissors the prostate was divided in the middle line on its floor deeply towards the rectum, one blade of the scissors being in the urethra and the other in the bladder. On each side of this cut another was made, about three-quarters of an inch from it, of equal depth, and with the fingers the pieces of prostatic tissue between these incisions were enucleated with considerable difficulty, the tissue being exceedingly tough. The level of the prostatic urethra was now flush with the pouched fundus of the bladder, the pieces of removed tissue being in the aggregate the size of a Tangerine orange. Bleeding was free, and as it continued, notwithstanding hot douching and temporary pressure, the wound in the prostate was packed with iodoform gauze, the ends being left out of the external wound."

At the end of three months the patient was passing all his urine naturally, and the bladder was emptied only about every two-and-a-half or three hours. The residual urine was only a few drachms. There was no pain.

"The case is reported to emphasize the necessity for a free removal of prostatic tissue when prostatectomy is undertaken. The want of boldness in doing this is probably the cause of failure in most of the cases where operation has failed to give relief and the bladder muscle is not in a condition of atony."

Partial removal of the enlarged prostate has, it is true, been followed on several occasions by a further reduction in the size of the gland, and by apparently a disproportionate amount of improvement in the action of the bladder. The same result, too, is recorded as having followed incision, drainage through the perineum (Harri-

son), puncture with the galvano-cautery (Wishard), and drainage through a supra-pubic opening (Packard and Broome). And as there is no question that the risk increases with the amount removed, it has been suggested that complete enucleation of the obstructing body is unnecessary, that excision need only be partial: what is left will atrophy and leave the route clear, and the result will be equally good, with a smaller amount of danger. There is no proof, however, that the reduction in size in any one of those mentioned was due to atrophy. In no case does the diminution appear to have been more that could reasonably be accounted for by the subsidence of congestion, cicatrization and fibroid contraction of the adenomatous growth. In nearly every instance in which the amount of improvement was greater than had been anticipated there had been recent acute retention of urine or septic cystitis or both. Under these conditions the prostate always undergoes an enormous but a temporary increase, and the symptoms are made infinitely worse by the swelling of the mucous membrane and the plugging of the periprostatic plexus with thrombi. Such cases often improve materially when treated by catheterization and rest in bed, the gland diminishing very greatly in size in the course of a few weeks; and, in the absence of all microscopic proof, there is no evidence that the benefit which was undoubtedly experienced in some of these cases was not due to a similar cause (see paper by author, "Lancet," April 21st, 1894).

A perineal incision is not only of advantage for exploring the prostatic urethra; it can be made use of afterwards for drainage. It is true that the bladder can be drained nearly if not quite as well supra pubes as through the perineum. When the tension of the abdominal wall is removed, the pressure of the abdominal viscera from behind and above is sure to keep it empty. But this only holds good so long as the operation is confined to the bladder. The prostatic portion of the urethra cannot be drained like this. When the operation has extended into it, unless there is a perineal opening, it forms a conical receptacle at the lowest part of the wound, forming part of the wall of the wound, filled with blood and decomposing urine.

A large soft drainage tube should in any case be secured in the bladder through the supra-pubic wound, and the other end conducted to a vessel under the bed. The upper end of the wound

should be closed, taking care to bring the aponeurosis together as well as the skin, and some soft absorbent dressings applied. These must be changed every two hours or as often as they become saturated. The patient should be encouraged to sit up in bed as soon as he has come round from the anæsthetic, and should be got up as soon as his strength will permit.

Supra-pubic prostatectomy is the only operation that deserves to be called radical. Pedunculated outgrowths or small median enlargements can, it is true, be dealt with in other ways. This, with one exception (the combined operation of Dr. Nicoll), is the only one that is effective in every form.

Perineal prostatectomy succeeds admirably under certain conditions. If it is known beforehand that the symptoms are caused by a valvular outgrowth, and that there is no other conspicuous change (such cases are rare, but they do occur), all that is required can be accomplished through an incision no larger than that made in external urethrotomy. But this is almost the limit, and even this could be accomplished through a supra-pubic opening equally well, and without appreciably greater risk. Supra-pubic cystotomy, if there is no more manipulation than that required for the snipping or twisting off of a pedunculated median lobe, is an exceedingly successful operation. But if more than this is attempted through the perineum, if for example it becomes necessary to enucleate the lateral lobes, the efficiency of the operation in comparison with the supra-pubic one rapidly diminishes, and the risk equally rapidly increases. The utility of the perineal operation is, therefore, very limited.

The only cases in which the supra-pubic operation is inadmissible are those in which the bladder has been reduced by persistent cystitis to a small, hard-walled sac, incapable of holding more than a few ounces. In such the space may be so limited that the necessary manipulation cannot be carried out. But in these it is questionable whether a radical operation at all is advisable, whether, looking to the condition of the bladder and its probable chance of recovery, drainage would not be preferable.

Lateral as well as median lobes can be dealt with equally well through a supra-pubic opening, and the perineal distance, except in so far as it indicates a great increase in bulk of the gland, is of no consequence. Vesical outgrowths cannot be removed in any other way.

Through a supra-pubic opening the interior of the bladder and of the prostatic urethra can be examined, and inspected thoroughly; calculi can be removed; phosphatic débris scraped from the wall; the existence of sacculi ascertained; the exact amount and shape of the enlargement and the relation that it bears to the cavity made out; the degree of resistance in the posterior wall of the urethra felt; the effect that the removal of the obstruction has upon the outlet from the bladder accurately gauged at the time, so that no more, or no less, than is necessary is done; hæmorrhage can be dealt with equally well, if not better than by the perineum; and drainage after the operation, even if a perineal opening is not made (and this addition to a supra-pubic operation adds very little to the time that it takes or to the risk) is equally good.

THE COMBINED METHOD.

Belfield, as already mentioned, was the first to draw attention to the advisability, and in some cases the necessity, of adding a perineal opening to the supra-pubic operation, in order to make it effectual. The combined method as carried out by Dr. Nicoll, of Glasgow ("Lancet," April 14th, 1894), differs from this, in that the mucous membrane of the bladder is carefully kept intact, and the perineal wound never allowed to communicate with the bladder or the urethra.

Supra-pubic cystotomy is performed first. The wall of the bladder is secured to the skin by four sutures, the mucous membrane thoroughly cleansed, and the cavity partly filled with carbolic solution (one part in two hundred). The patient is then placed in the lithotomy position and a sound or bougie passed and given to an assistant. "The left forefinger in the rectum, an incision is made in the perineal raphe and gradually deepened until the apex of the prostate is reached, but without penetrating the urethra or the bladder. The rectum is carefully separated from the posterior surface of the prostate, and a vertical incision is then made through the posterior and inferior part of the prostatic capsule. The capsule is then gradually shed off the gland to either side by means of some blunt instrument like a periosteum elevator, the assistant meantime pressing the prostate down into the perineal wound with his fingers, introduced into the bladder by the supra-pubic opening. (If sufficient room for this isolating of the prostate has not been

afforded by the median perineal wound it may be obtained by supplementing the median incision by a lateral one, somewhat on the lines of Dittel's, and curving outwards and backwards from the posterior end of the median cut to a point between the anus and the posterior end of the ischial tuberosity, nearer the former than the latter. This may be done on one or both sides.) All bleeding points being secured, the surgeon, after carefully washing his left index finger in carbolic solution, puts two fingers of the left hand into the bladder from the supra-pubic wound, and, pressing the prostate (now pretty freely movable) down into the perineal wound, removes, by the fingers of his right hand in the perineum, the entire prostate, or as much of it as he deems necessary to relieve the neck of the bladder from all pressure, and bring it down to a level with the post-prostatic pouch in the base of the bladder, judging the amount to be removed by manipulation of the parts between the fingers of the two hands. Should the prostatic tissue be more than usually tough and resistant, the fingers of the right hand may be supplemented by a blunt periosteum elevator or other similar instrument, or even by a Volkmann's spoon carefully used. During the entire operation neither bladder nor urethra is opened further than is involved in the supra-pubic incision. After enucleation of the prostate is complete the sound or bougie is withdrawn and a large-eyed, short-beaked metal catheter (such as a lithotrity evacuating catheter) or a large elastic-gum catheter coudé is introduced and tied in. The perineal wound, which forms a cavity of some magnitude, is douched with weak carbolic solution, carefully dried with gauze or sponges, and firmly stuffed with iodoform gauze. The four stitches in the supra-pubic wound are cut and the bladder-wall thus permitted to drop away from the parietes. The after-treatment consists mainly in douching out the bladder daily with boracic or weak carbolic solution, from the supra-pubic wound into the bladder, and out through the catheter in the urethra. The iodoform packing is changed every second or third day for a fortnight and then withdrawn, and the wound allowed to close. The supra-pubic wound, which is kept covered by a pad of sublimated gamgee, also begins to close about this time, when the douching may be discontinued.

"The advantages this method of prostatectomy appears to offer in comparison with the others are: (*a*) There is much less hæmorrhage. This is but what might, *à priori*, be expected. The prostatic plexus of veins lies on the surface of the prostate

(not in its substance, which is little vascular), and is consequently largely shed off with the capsule by the blunt periosteum elevator. Further, the plexus clothes mostly the anterior and lateral aspects of the organ. In approaching the prostate on the posterior and inferior surface few veins are encountered. (*b*) The infiltration of the freshly-wounded tissues by the putrid and septic urine is avoided. In the removal of the body and lateral lobes on any adequate scale a large gaping cavity is created. In the supra-pubic operation no means of efficiently draining this exists, nor is the perineal tube introduced in the perineal or combined operation of any service in the matter, the greater part of the cavity lying below the level of the aqueduct from the bladder to the skin orifice along the tube, and thus retaining the fluid which gravitates into it. By the operation described this cavity is kept absolutely free from either putrid or putrescible urine and filled with a dry antiseptic medium. (*c*) The operation insures adequate and sufficient removal of the obstructing prostatic tissue, thereby avoiding one main source of ultimate failure to give relief to the symptoms in both the perineal and supra-pubic operations when uncombined. (*d*) By preserving the bladder-wall intact there is very much less risk of tearing out portions of the deep urethra and bladder-wall, with the subsequent possible results mentioned above. With a bougie in the urethra and two fingers in the bladder there can with due care be very little chance of removing any of the bladder or urethral wall with the prostatic tissue. Such tearing out of portions, not unknown in the supra-pubic operation, is comparatively common in both the perineal and ordinary combined perineal and supra-pubic operations. (*e*) The absence of a perineal tube permits the patient to sit up without inconvenience from the first."

A similar operation has been performed by Macewen.

In those cases in which there is a median vesical projection Dr. Nicoll suggests the advisability of leaving it at the time of the operation, and after eight or ten days, when the urine has become aseptic and the cavity of the perineal wound is covered with granulations, reflecting the mucous membrane from over it and twisting it off by itself. He also points out that portions of the vesiculæ seminales and vasa deferentia are sure to be removed, but that even if subsequent atrophy of the testes is involved (a moot point) this is of comparatively small consequence to elderly men slowly dying from the effects of prostatic obstruction.

CHAPTER XI.

CASTRATION IN ENLARGEMENT OF THE PROSTATE.

Removal of the testes is followed in a large proportion of cases, if not in all, by complete and rapid absorption of the enlarged prostate. This has now been proved conclusively. The gland entirely disappears; nothing is left but a little fibrous mass.

The conception that this result might follow the operation of castration became possible, for the first time, when the sexual character of the prostate was established. So long as the erroneous theory prevailed that the gland was an appendage to the bladder, and in some way connected with micturition, further progress was out of the question. When this was swept away, and the dependence of the prostate upon the existence of the master sexual organs once more brought clearly forward, the argument that fibroid tumours of the uterus diminish in size when the ovaries, the corresponding female organs, are removed, was at once followed by its natural deduction.

As frequently happens in such cases, the same idea appears to have occurred more or less definitely to many people almost at the same time. In November, 1892, shortly after the publication of my Hunterian Lectures, I discussed the advisability of the operation with a patient who, though he admitted the force of the arguments in favour of it, not unnaturally declined it on the ground that it must be of the nature of an experiment. In 1893, in an admirable paper read before the American Surgical Association, Professor White, of Philadelphia, summed up all that was known in favour of it, admitting at the same time that he had, as yet, formed no convictions upon the subject. In April of the same year Professor Ramm, of Christiania ("Centr. f. Chir.," No. 35, Sept. 2nd, 1893), performed it, for the first time, with this object.

The evidence is not extensive, and some of it is based only upon analogy; but so far as it goes it all points in the same direction.

The prostate is wholly and entirely a sexual organ. It has nothing to do with micturition, except so far that by lending a

certain amount of mechanical support to one portion of the urethra it enables that part to dispense with complex walls of its own.

Hunter ("Works," Vol. iv.) and Owen ("Comp. Anat. of the Vertebrata") long since proved that —

(1) Removal of the testes in the young prevents the development of the prostate;

(2) That a similar operation in the adult causes it to atrophy—this has been confirmed independently by White and Griffiths (*loc. cit.*)—and that

(3) In those animals in which the development of the sexual organs varies with the time of the year the prostate presents differences quite as striking as those of the testes. Griffiths has also shown that the atrophy is almost immediate in its appearance, coming on within a few days, and that it affects the stroma as well as the glandular part.

That the first two statements are equally true of man is also certain. The number of observations is much smaller, but they are all positive, none even doubtful.

So far, then, as the normal prostate is concerned it may be taken as proved that the removal of the testes induces in it changes analogous to those that are produced in the uterus and the mammary glands by the removal of the ovaries.

This, of course, does not prove that castration would have a similar effect upon the enlarged gland. The structure of the enlarged gland differs a good deal from that of the normal one. And it has been stated, on good authority, that sexual excitement, erection, and emission may occur after castration, and be continued even for several years. Evidence, however, is by no means wanting.

There is the analogy of fibroid tumours of the uterus. It is undoubted that after oophorectomy they diminish in size. (It may not seem fair to make use of this argument after what has been said before on the absence of homology between the prostate and the uterus, but the point is a different one. There is no homology between them, but the relation that the uterus bears to the ovaries may be compared with that which exists between the prostate and the testes.)

Enlargement of the prostate rarely begins after an age at which it may be presumed the testes are no longer functional. "An examination of Messer's tables, founded on a dissection of one hundred prostates in men over sixty years of age ("Med. Chi.

Trans.," Vol. xliii., p. 147) discloses one interesting fact in this connection. Assuming, arbitrarily, that eighty may be taken as the age at which, in the great majority of men, the sexual life is absolutely and finally ended, we find that among those subjects whose prostates weighed over six drachms, the percentage of octogenarians or their elders was only 22·8, while among those whose prostates weighed less than six drachms (many of them less than normal) the percentage was 35·3, more than half again as great.

"This is not only confirmatory of Desnos' observation ("Dict. des Sciences Med.," 2 Series, tom. xxvii., p. 506) that after a certain period in life the frequency of notable hypertrophy diminishes, but it suggests the possibility that in many of these cases physiological atrophy had already begun. The subjects were not selected from among patients, but just as they happened to come within reach of the investigator." (White, "Annals of Surgery," 1893.)

Sir G. Humphry states that of seventy-two persons between 80 and 90 years of age, only 17, and of thirty above 90, only one, suffered from urinary troubles referable to enlargement of the prostate.

But there is also direct evidence. There are nine cases reported in which definite diminution in size, with subsidence of urinary troubles, has been recorded as following castration. The first was accidental.

(1) "A man, aged 65, had for months attended the extern department of the Belfast Royal Hospital, while I was Resident Surgeon there in 1887, for retention of urine due to enlarged prostate. He developed a nodule in the right testicle, for which he was admitted and castrated by Mr. Fegan.

"After his discharge he did not visit the extern department for three months, as he had no urinary trouble, and came then only to report himself. The left testicle was small and probably useless, as he had been impotent since the removal of the right.

"I made a rectal examination to detect any recurrence of the tumour in the vasa or vesiculæ seminales, but found none. I was much struck by a marked diminution in the size of the prostate, which accounted for the relief of his urinary trouble." (Arthur Powell, "Brit. Med. Journ.," Nov. 18th, 1893.)

The two next were under the care of Professor Ramm, of

Christiania ("Central. für Chirurgie," No. 35, Sept. 2nd, 1893, and No. 17, April 28th, 1894).

(2) The patient was seventy-three years of age. For fifteen years there had been difficulty in micturition, and for the last year he had passed urine almost every hour. The prostate as felt per rectum was about the size of a medium-sized orange. Bilateral castration was performed on April 3rd, 1893. Three days after the operation the prostate was distinctly smaller, and it has since steadily diminished, being now a flat mass. After the operation and during the first two months the catheter was passed three or four times to relieve temporary retention. Now he passes water as well as he ever used to, and has only to empty the bladder twice during the night. The patient was shown before the Medical Society of Christiania twelve days after the operation.

(3) The patient was 67½ years of age. There had been difficulty in micturition for fourteen years. In 1886 there had been complete retention, and in 1892 the bladder had been punctured supra pubes. The prostate was very large and its upper border could only just be reached by the finger in the rectum. Bilateral castration on April 25th, 1893. During the night following the operation he passed a good stream of urine. In eleven days the prostate had distinctly diminished. Six weeks after the operation he could stand up and pass a good stream of urine. At the present time the prostate is a small flat mass with a median ridge in the position of the urethra. He now passes urine four or five times during the day and once only during the night, all the difficulty in making water and all the cystitis having completely disappeared.

(4, 5, and 6) Dr. Francis L. Haynes, of Los Angeles, California ("Buffalo Med. and Surg. Journal," March, 1894), is responsible for three more. "Following the suggestion of Professor White, of Philadelphia, I have three times made double castrations in old men afflicted with prostatic hypertrophy. (1) Operation eighty-four days ago in a case of two years' standing of moderate severity. The patient is practically cured. (2) Operation forty-seven days ago in a desperate case, requiring catheterization every two hours, complicated by intense cystitis and by morphinism acquired as a result of frightful suffering. With the most devoted nursing this old man has improved wonderfully. Cystitis has disappeared; one-third of the urine is passed spontaneously; catheter is used about four or five hours; morphinism has been cured; general

condition good. (3) Operation fourteen days ago. Incipient case; catheterization almost impossible because of the peculiar development of the prostate."

In a fourth case section of the vas deferens gave no definite results.

(7) Dr. Fremont Smith, at St. Augustine, Florida ("Genito-Urinary Section of the New York Academy of Medicine") describes a seventh. After consultation with Professor White, castration " was performed in an apparently hopeless case of hypertrophied prostate with marked sepsis, cystitis, beginning uræmia, etc. Fifteen weeks after the operation the patient had gained 45lbs. weight, and has no symptoms of cystitis or other urinary trouble. He urinates freely and normally."

(8) Professor White operated on " a medical man, aged 69 years, who had a very large prostate, about half the size of an orange; who had passed no urine except by catheter for years; whose urine was loaded with mucus, was offensive, and at short intervals was filled with blood. At this time—fourteen weeks later—while he has not yet urinated spontaneously, rectal examination shows a reduction of the size of the prostate to about its normal dimensions. The catheter, which was formerly introduced for 9½ inches before reaching urine, now goes in only eight inches, when urine begins to flow. Its introduction is easy and painless, instead of difficult and very painful. No blood has appeared in the urine for two months. The urine itself is entirely normal in appearance, odour, and in all other respects." ("Brit. Med. Journ.," June, 1894.)

(9) The ninth case was under my care. The patient, who was eighty-one years of age, had suffered on many occasions previously from attacks of retention. Finally in June, 1894, his condition became so bad that no catheter could be passed, and the bladder was distended up to the umbilicus. Supra-pubic aspiration was performed. This relieved the congestion so that a little urine could trickle away, and though the bladder remained full, extreme distension did not occur again. At the end of a fortnight there was no improvement. The prostate was of enormous size (it felt as large as a Tangerine orange); it completely blocked the urethra so that no catheter could be passed; cystitis had set in and the patient's strength was evidently failing. Castration was performed. The next day the urine came more freely. Ten days later the

prostate had diminished considerably in size. Three weeks after the operation the gland had disappeared. An ordinary silver catheter could be passed without depressing the handle more than usual; and when the finger was introduced into the rectum all that could be felt of the mass that had been there previously was a fusiform thickening not sufficiently large or dense to prevent the shaft of the instrument being distinctly perceived through it. (Brit. Med. Ass., Aug., 1894).

In addition to these Mr. R. Harrison ("Brit. Med. Journal," September 23rd, 1893) records that on one occasion, at the patient's urgent request, he divided the vasa deferentia subcutaneously with the view of averting further urinary troubles in a case of hypertrophied prostate, and that six or seven years afterwards the patient was alive and well. Dr. Griffiths, however ("Brit. Med. Journal," September 30th, 1893), has pointed out that in animals section of the vasa deferentia is not invariably followed by atrophy of the testes, and, therefore, too much reliance must not be placed upon this. This agrees with the observation of Dr. Haynes, already quoted. It may be that the results vary with the time of life, for section or ligature of the vas deferens in youth (in men) is usually followed by atrophy, though the diminution in size may not show itself for some months.

Putting these facts together it must be admitted that in cases of enlargement of the prostate castration is followed by complete atrophy (a change totally different from disappearance of congestion and shrinkage after puncture) and subsidence of all urinary troubles, so far as obstruction to the exit is concerned. If the muscular coat of the bladder has been destroyed by long continued inflammation, it cannot, of course, be restored, and catheterism must be continued. But Professor Ramm's two cases of fourteen and fifteen years' duration are most encouraging in this respect, and in mine the result was equally good. And it must be remembered that catheterism when the prostate is atrophied is a very different matter from the same thing when there is enormous and obstructive enlargement.

Whether it will succeed in all forms of enlargement alike cannot be answered yet, but there is no evidence to the contrary. It has succeeded in all in which it has been tried.

The final answer must, as Professor White suggests, be left to

our patients. But I cannot help thinking that if they could appreciate and understand the facts as they are known to us at present and without further addition, many of them dying deaths of slow and inevitable torture would embrace at once the chance of rapid and permanent relief afforded them by this operation, at a time of life when none of the secondary sexual changes that follow it in youth would be likely to make their appearance.

CHAPTER XII.

CONCLUSIONS.

ENLARGEMENT of the prostate does not require treatment for its own sake. It may attain an enormous size without the possessor being aware of its existence. Treatment becomes necessary as soon as the growth begins to interfere with the function of the bladder.

Nothing can be gained by delay. The longer it is left, the greater the risk, whatever plan is adopted.

The choice lies between the habitual employment of a catheter; removal of the obstruction by operation; and, when nothing else is available, the formation of another route of exit or castration.

In all ordinary cases, unless the disease is already advanced or some special feature is present, catheterism is to be preferred.

"It may be said at once that in those patients with but moderate obstruction, or with a high grade of compensatory hypertrophy of the bladder, with a small amount of residual urine, which remains sterile, and in whom catheterism is easy and painless, operation is not to be thought of" (White, "Annals of Surgery," August, 1893.)

On the other hand, when certain anatomical conditions which interfere with the function of the bladder are present; or when, though the catheter may have succeeded at first, the patient is beginning to fail, the bladder losing its power, or the amount of residual urine increasing, or inflammation setting in, prostatectomy should be performed before it is too late.

These cases include the following:—

1. When there is a valvular upgrowth projecting into the bladder from the margin of the orifice, or when there are three meeting together over it as the bladder contracts. Retention is complete or almost so; a catheter must be passed at least four times a day for the rest of life; and the patient must never, day or night, be without one.

2. When there is an upgrowth in the median posterior wall of the urethra, or when the lateral lobes have grown up and raised between

them a fold of mucous membrane. The condition, so long as the amount of residual urine is small and remains stationary, is not so urgent as the preceding one; retention is not complete, and for a time relief can be obtained by passing a catheter once a day. But an increasing quantity means that the treatment by catheter is beginning to fail.

3. When there is an intravesical growth causing irritation. These are not so common as the others. The growths may be large or small. As a rule they are near the neck, and soft and vascular, with an area of hyperæmic mucous membrane around them. Retention may or may not be present, according to the situation; but the irritability is intense, night and day. There is a great tendency to hæmaturia, and cystitis never fails to make its appearance early.

4. When there is difficulty in passing the catheter owing to the shape of the urethra or the presence of false passages, when hæmaturia is of constant occurrence, or when the patient will not or cannot take the necessary precautions. Under these conditions the employment of instruments only makes matters worse by the injury it inflicts. Septic cystitis is sure to follow, and catheterism becomes infinitely more difficult at the time when the need for it is greatly increased.

5. In cases of habitual catheterism, when the muscular coat of the bladder is losing power, or the specific gravity of the urine is beginning to fall, without there being any sufficient constitutional reason, such as general atheroma, to account for it. Persistence in catheterism under such circumstances can only end in disaster.

6. When the passage of a catheter is always causing cystitis. The precautions that must be observed when a catheter is habitually used, or even when it is used at all, have been mentioned in detail already. Here it need only be said that in some instances the greatest possible care is unable to prevent this result. As McGill has said, one man may carry his catheter in his hat, and never change or wash it, without any ill result, while another who takes every care suffers almost every time it is used. There is a personal factor in the occurrence of cystitis which must be considered with other causes.

7. When septic cystitis has broken out. Left at the mercy of a method of treatment that has failed already, the state of the bladder will surely progress from bad to worse. Septic cystitis ›

with enlargement of the prostate, means uræmia at last. The attack may, it is true, subside under drainage and other energetic treatment, but sooner or later, as the conditions remain the same, the inflammation will return, and bring nephritis with it.

For cases such as these habitual catheterism cannot be recommended. It may succeed in a few for a time; in the majority sooner or later it is bound to become a slow and fatal form of torture.

The alternative, if the patient's constitution is sound, is some form of prostatectomy. Where this is not practicable, on account of the size of the growth or for other reasons, or where the risk is too great, an artificial urethra should be made before the disease (or its treatment) has inflicted irreparable injury upon the kidneys.

"I have no hesitation in saying that in the absence of evidence of advanced and threatening renal disease of an infective character, but few prostatics, no matter how marked their local symptoms, should at the present day be denied the chance of relief afforded by operation. In this statement I would include not only the cases with pronounced vesical sepsis, but also those with atony; with more or less complete retention; with general sclerosis, rigid vessels, polyuria, and hyaline casts; with even the toxæmia above alluded to. The evidence already presented to the profession seems to me to warrant this opinion, in spite of the unfavourable views as to operative interference formed and expressed by such excellent and experienced observers as Socin, Guyon, and Sir Henry Thompson" (White, *loc. cit.*).

Of the possibility of removing the obstruction there is no longer any question. It may be done either supra pubes or through the perineum. The former is more generally useful. The latter succeeds conspicuously well in picked cases.

The risk attendant upon the operation depends upon the extent to which the patient's constitution has already suffered. Age, in comparison, has but little influence.

Prostatectomy is credited with a very high rate of mortality. The statistics of the supra-pubic method, published in my "Hunerian Lectures," showed that it had proved fatal in upwards of wenty per cent. At the same time, I pointed out that while the mortality in the whole number of ninety-four cases (arranged chronologically) was twenty per cent., that of the first half was wenty-five and that of the last half fifteen, showing already a very

great improvement. And I ventured to predict that the rate would fall much lower still, at least in the hands of those operators who are practised in the performance of it.

Events have proved that I was right. There has not been, it is true, any such series of statistics published since, but Mayo Robson, for example ("Clinical Journal," March, 1894), has performed this operation eleven times without having had to record a death, and others have met with an almost equal degree of success.

In comparing the mortality that follows supra-pubic prostatectomy with that of habitual catheterism, it is essential that there should be some resemblance between the cases in which the two methods are employed. This condition has not yet been fulfilled. In my own statistics the total number of cases collected was ninety-five. Of these two must be omitted as not relevant to the inquiry. In seventy-three of the rest the condition of the bladder is mentioned, or can be inferred beyond the shadow of a doubt. Out of these seventy-three septic cystitis (urine foul, phosphatic calculi, and the like) was present in no less than sixty-four. In making the comparison these sixty-four cases cannot be included. It is not fair to compare the results of supra-pubic prostatectomy after the bladder has been ruined and the patient brought to death's door by habitual catheterism with those of habitual catheterism starting with a healthy bladder and a healthy patient. The result in these sixty-four can only be compared with what might have followed had simple drainage through an artificial urethra been employed, or what certainly would have followed had the catheterism been continued. The balance would not be in favour of the catheter.

In the early stages of the disease, while the urine is still sterile, before the bladder and kidneys are seriously involved, at the time when it is becoming apparent that catheter life, which may have promised well at first, will be a failure, there is no reason why supra-pubic prostatectomy should be attended by a higher rate of mortality than supra-pubic cystotomy for the removal of villous growths or for other purposes.

If this time is allowed to pass by and the treatment by catheter is continued, in spite of its manifest inefficiency, until the urine is septic or the kidneys are involved, the rate of mortality will, of course, be increased. But now the first object is not to relieve the patient, but to save his life, which is in very serious danger if the same treatment is continued.

When this stage is reached, the choice no longer lies between catheterism (which has failed) and prostatectomy, but between prostatectomy and the formation of an artificial urethra.

It depends upon the extent to which the patient's constitution has been injured. When the urine is septic, the bladder inflamed, and the kidneys diseased, prostatectomy is undoubtedly more serious than puncture or incision. The relief that it gives, it is true, is more complete. In the case of drainage, an appliance must be worn permanently. Even with the best results, after the modifications introduced by McGuire and Morris, of New York, it is not possible to dispense with everything ; a plug or something of a similar character must be worn to keep the channel patent and straight. On the other hand, after prostatectomy, if a sufficient amount is removed, the power of voluntary expulsion will be regained.

If there is the least doubt as to the condition of the patient, suprapubic cystotomy should be performed first, and a large drainage tube inserted. Then, after a week or ten days, when the urine has become aseptic and the patient has to some extent regained his strength, the enlargement can be removed if it is thought advisable, either by the supra-pubic or by Nicoll's combined method. This method of dividing the operation possesses several advantages.

The amount of blood lost is diminished. The hæmorrhage caused by cutting into an intensely congested prostate may be very serious.

The risk of septic absorption is very much lessened. This, of course, only holds good for the supra-pubic operation, not the combined one; in this the mucous membrane of the bladder is kept intact.

The second half of the operation may not be required. In a case of septic cystitis of long-standing, it is almost impossible to determine at the moment when the bladder is opened how much of the increase in size of the prostate is due to over-growth, and how much to congestion and œdema, caused by the inflammation of the mucous membrane covering it and the ceaseless spasm of the muscles around it. It sometimes happens that at the end of a week or ten days the gland has diminished so much in size and the symptoms are so far relieved that further treatment is not necessary. Some of the urine comes by the natural route, and the

rest escapes without much inconvenience through the opening that has been made. As already mentioned, there is no question of atrophy; this is certainly not proved, but the reduction in size is so conspicuous and has been noted by so many observers, that the possibility of its occurrence must be taken into consideration, and sufficient time allowed for it to take place if it will.

The relative merits of the supra-pubic and the perineal routes have been discussed already.

Can the bladder recover? It has been objected that, even if the obstruction is removed, the bladder is incapable of recovering; that the loss of power is due to primary muscular degeneration. This is certainly not true of the majority.

Loss of power in enlargement of the prostate is caused by a valvular out-growth, which prevents the bladder working to advantage, or by catheterism, persistent congestion, or inflammation, or by all of these acting together. The causes are local and can be removed, and when this has been done, unless the delay has been too long, the bladder will recover.

It is true that twenty per cent. of the cases published in my statistics failed in this respect. But in several of them the obstruction was not sufficiently removed, and, as regards the rest, it is hardly a matter for surprise when the character of the cases is taken into consideration. No one has ever maintained that septic inflammation, when continued for a sufficient length of time, is incapable of destroying muscular fibres. The fault was not that of the operation, but of the prolonged delay, in some instances amounting to as much as fifteen years. Even in many of these cases, however, there was a material improvement in comfort after the operation.

Will the obstruction return? This depends very greatly on the completeness with which the removal is effected. Mercier's operations, in the hands of other surgeons, at least, have all proved failures from this cause. So have some of Gouley's, and so, in all probability, will some of those in which a channel is merely burnt or cut out in the median posterior line. On the other hand, after the supra-pubic operation, putting aside those instances in which removal was distinctly insufficient, there is only one case recorded in which definite recurrence took place, while there is abundant evidence to the contrary. Not only are there cases in which the patient has lived in comfort without the need for a catheter for

years after the operation, but there are others, four mentioned in my "Hunterian Lectures" and many since, in which the *post-mortem* examination years after the operation has proved that the growth had not returned, and that the channel remained perfectly free.

Finally, even in the worst cases, where everything has failed, there is one hope left—castration. The risk to life is slight. The absorption is complete. The recovery of power in all cases, hitherto, has been as perfect as after any form of prostatectomy. The alternative, for of course it would not be proposed in any of the early stages of the disease, is certain death at no distant period by a slow but fatal form of torture. And the operation has met with a sufficient amount of success to justify the choice being laid before the patient.

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